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Economic policy uncertainty and sovereign credit rating decisions: Panel quantile evidence for the Eurozone

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ABSTRACT

We employ a panel quantile framework that quantifies the relative importance of quantitative and qualitative factors across the conditional distribution of sovereign credit ratings in the Eurozone area. We find that regulatory quality and competitiveness have a stronger impact for low rated countries whereas GDP per capita is a major driver of high rated countries. A reduction in the current account deficit leads to a rating or outlook upgrade for low rated countries. Economic policy uncertainty impacts negatively on credit ratings across the conditional distribution; however, the impact is stronger for the lower rated countries. In other words, the creditworthiness of low rated countries takes a much bigger 'hit' than that of high rated countries when European policy uncertainty is on the rise.

1. Introduction

During the global financial crisis of 2007–2009 and the subsequent recession, Central Banks and governments responded by injecting additional liquidity into the system and pursuing expansionary fiscal policies, respectively. With the world economy in (the process of returning to) normality, fiscal positions are also being tightened up. Nevertheless, the significant deterioration of public finances post 2007[1] has put on alert Credit Rating Agencies (hereafter CRAs). For instance, Moody's Investor Services, a major credit rating agency, has downgraded over the 2008–2013 period the debt rating of a number of peripheral European countries, namely Greece, Ireland, Italy, Portugal, and Spain (hereafter the GIIPS) and Cyprus by 63 notches in total.[2] Similar decisions have been implemented by the other two main CRAs, namely Standard & Poor's (S&P's) and Fitch Ratings, respectively.[3]

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[1] For instance, the International Monetary Fund estimates that gross debt in thirty-nine advanced economies deteriorated from 71.2% of GDP in 2007 to 107.5% in 2016 whereas gross debt in the Euro area deteriorated from 64.9% of GDP in 2007 to 91.7% of GDP in 2016. Data available from: https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/weoselagr.aspx.

[2] In particular, Greece, Ireland, Italy, Portugal, Spain and Cyprus have been downgraded by 14, 10, 6, 10, 9 and 14 notches, respectively by Moody's.

[3] The three main CRAs have a total EU market share of 92.85% (see https://www.esma.europa.eu/sites/default/files/library/20161662_cra_market_share_calculation.pdf).

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Sovereign credit ratings provide a measure of the probability that a country will default on its debt obligations. In that sense, they set the tone for gauging borrowing costs in international markets both for a sovereign state and the financial institutions operating in that sovereign state (for recent evidence, see Drago and Gallo, 2017). This is vital for stimulating investments and supporting economic growth.

Reputational concerns do discipline the decisions made by CRAs (see e.g. Bar-Isaac and Shapiro, 2013 and Mariano, 2012). However, the value of reputation depends on economic fundamentals that vary over the business cycle. Using a theoretical model of credit ratings with endogenous reputation, Bar-Isaac and Shapiro (2013) relate credit ratings decisions to the economic cycle. They find that CRAs are more likely to issue less accurate ratings when fee-income is high, the economy is booming and securities' default probabilities are low. Indeed, during booms, hiring skilled analysts becomes more expensive for CRAs. At the same time, CRAs can potentially charge higher fees and since bond issues are less likely to default, monitoring a CRA activity becomes less effective.

Although the recent empirical literature has discussed a number of quantitative and qualitative factors affecting the decisions of CRAs, an increasingly large number of decisions appear to remain unexplained. For instance, some of the downgrades of peripheral European debt which took place in 2010 and beyond have been contested by the downgraded peripheral countries and by prominent European policymakers. Speaking to the European parliament in May 2010, Jose Manuel Barroso, then the European Union Commission President, criticised the three main CRAs noting that "deficiencies in their working methods has led to ratings being too cyclical, too reliant on the general market mood rather than on fundamentals-regardless of whether market mood is too optimistic or too pessimistic" (Barroso, 2010).

In a letter published in March 2011 by *The Economist*, David Beers (2011), Standard & Poor's (at that time) Global head of sovereign ratings, defended the record of the CRAs. He noted that credit ratings "provide a robust ranking of the risk of sovereign default" and "are independent opinions of creditworthiness based on fundamental analysis and therefore should be expected to change as credit risk evolves over the cycle". Gärtner and Griesbach (2012) argued that "sovereign ratings, their meaning and their underlying procedures are rather opaque". They also went on to argue that "the set of relevant fundamental variables is an open one, and the interpretation of ever evolving political institutions and processes in unprecedented environments are a dime a dozen". Moritz Kraemer, Global Chief Rating Officer of Standard & Poor's, dismissed the arguments of Gärtner and Griesbach (2012) as "simply wrong" and went on to note that S&P's sovereign rating decisions are accompanied by comprehensive published rationales and, often, press releases that explain their reasoning and approach. Kraemer (2012) also pointed out that S&P's explain on their website how they arrive at their ratings and how their ratings perform over time (see www.understandingratings.com) which makes their publications as transparent and complete as possible.

The growing dissatisfaction across Europe about some of the recent credit rating decisions, has given rise to talks among Eurozone member states about setting up a European credit rating agency which will increase competition in the rating business. Nevertheless, the European Central Bank (ECB) has been very cautious about how quickly such a project could be deployed. In February 2011, the ECB pointed out that a new credit rating agency will have to rely on extensive data, a number of models, experienced staff and go through building a sound track record for several years before it establishes itself as a credible agency in the rating business (Tait, 2011). In 2016, European Securities and Markets Authority (ESMA), which is the authority competent for the supervision of CRAs, published a report on sovereign ratings processes which noted that because of a "switch to a regulated industry with focus on integrity of process ... ESMA has driven significant changes in the credit rating process and the methodology ... thereby strengthening their integrity, independence, quality and transparency" (ESMA, 2016 Report, p. 16).

This paper attempts a comprehensive assessment of credit rating decisions made by the three main CRAs for the Eurozone economies in light of the ongoing criticism discussed above. The existing literature on the determinants of sovereign credit ratings has focussed on several macroeconomic, qualitative and risk factors. Recent studies focus on time-varying models of credit ratings (Reusens and Croux, 2017) and models with debt levels conditional on debt being above or below endogenously determined debt threshold levels (Hmiden and Cheikh, 2016). Prior to this, Afonso et al. (2011) examine differentiations across rating levels by splitting their dataset into two groups according to the ratings level, namely high-rated countries with credit grades BBB+ and above and low rated countries with credit grades BBB and below.

Arguably, however, the actual degree of importance of the different explanatory variables across the conditional distribution of sovereign credit rating has not been explored in detail as most of the studies focus on the average responses.

We fill the gap in the literature by implementing panel quantile estimation with nonadditive fixed effects as proposed by Powell (2016). Our contribution to the existing literature is summarised as follows: First, we employ a panel quantile framework that allows us to observe the relative importance of quantitative and qualitative factors across the conditional distribution of sovereign credit ratings rather than merely focussing on their conditional mean. Second, we augment the information set considered in previous studies by examining and identifying the significant impact of competitiveness and the European economic policy uncertainty index on the Eurozone sovereign credit ratings.

Among our findings, the unemployment rate, regulatory quality and competitiveness have a stronger impact for low rated countries whereas GDP per capita is a major driver of high rated countries. A reduction in the current account deficit or an increase in the current account surplus leads to a rating or outlook upgrade for low rated countries. Economic policy uncertainty impacts negatively on credit ratings across the conditional distribution; however, the impact is stronger on the lower rated countries. We quantify the effects of uncertainty on credit ratings by using estimates of our model under uncertainty to infer what credit ratings would have been had uncertainty remained at its pre-financial and pre-European debt crisis average

value. We find that economic policy uncertainty in the Euro area has reduced Greece's credit rating by some 3 to 4 notches at the height of the Eurozone crisis in 2011 and in 2012; the impact of uncertainty has been substantial but somewhat less severe for the remaining GIIPS and Cyprus. In other words, our empirical analysis suggests a pivotal role that economic policy uncertainty in the Euro area has played in downgrading the credit profile of Eurozone's periphery.

The structure of the paper is as follows. Section 2 discusses the data. Section 3 introduces the model and Section 4 presents the empirical estimates. Section 5 provides a discussion of our findings and offers some policy implications. Finally, Section 6 offers some concluding remarks.

2. Data

We use annual data from 2002 to 2015 for nineteen Eurozone countries (266 observations in total). Our dependent variable is the sovereign credit rating published by the three main international rating agencies, Moody's, Standard & Poor's (S&P's) and Fitch Ratings (attributed at the end of each calendar year). A linear transformation of credit ratings to numerical scale is implemented starting from 21 for the highest quality with a stable outlook (AAA for Fitch and S&P's and Aaa for Moody's) and ending to 1 for Default (D for Fitch and S&P's and C for Moody's). The difference between two continuous ratings with the same outlook is always equal to 1. Not only we account for changes in credit ratings, but we also consider changes in credit outlooks.[4] The difference between two continuous outlooks is always equal to 1/3, so the difference between two continuous ratings with the same outlook is always equal to one. Table 1 reports the linear transformation of credit ratings and provides details on the frequencies of the ratings per category.

We start by adopting a standard set of explanatory variables previously used in the literature (see e.g. Reusens and Croux, 2017; Dimitrakopoulos and Kolossiatis, 2016; Aizenman et al., 2013 and Afonso et al., 2011), namely GDP per capita, Government Debt, Current Account Balance, Inflation Rate, Unemployment Rate and Regulatory Quality Index. The expected impact of each explanatory variable on credit ratings is as follows:

1. GDP per capita – positive response: Higher GDP per capita coincides with a larger tax base and, therefore, an increased ability of the government to repay its obligations. This variable can also reflect the degree of economic development.
2. Government debt – negative response: A high stock of government debt implies higher interest rates to accommodate it. Therefore, additional financial resources are needed to repay debt obligations. A higher government debt can increase the risk of default.
3. Current account balance – uncertain response: On the one hand, a higher current account deficit can signal overconsumption, undermining prosperity in the long run. On the other hand, it might have a positive effect, taking into account the productivity of the additional investments and their potentially positive economic impact in the short run.
4. Inflation rate – uncertain response: Higher inflation rates are a sign of structural and macroeconomic imbalances in the government's finances. On the other hand, very low inflation might lead to a deflationary spiral (Reusens and Croux, 2017). If we were dealing with debt in domestic currency, high inflation reduces the real stock of government debt in domestic currency and partially offsets the negative impact of high inflation.
5. Unemployment rate – negative response: A country with lower unemployment has an efficient labour market. The lower is the unemployment, the greater is overall taxable income and the lower the fiscal burden for unemployment subsidies.
6. Regulatory quality – positive response: Our Regulatory quality index is a combination of several individual variables such as investment and financial freedom, business regulatory environment, competition policy, tax inconsistency, financial institution's transparency, public sector openness to foreign bidders and easiness to start new business.[5] A high value of regulatory quality index reflects the ability of the government to implement necessary regulations that can boost private sector development and increase investment and GDP. Moreover it can be a qualitative quantification of the government's willingness to repay its obligations. Fig. 1 plots the regulatory quality index which shows a fair amount of cross-sectional variation; we note that Greece and Slovenia lag behind the remaining countries for most of the sample whereas Finland, Ireland, Luxemburg and The Netherlands are at the top of the list at the end of our sample.

We further augment our information set by considering two additional explanatory variables. The first one is the Competitiveness Indicator; an increase in the index implies lower competitiveness which can affect negatively on the credit rating decisions.[6] Indeed, lack of competitiveness impacts negatively on a country's ability to attract private investments in an international environment. Weak competiveness is often highlighted by government authorities and international organizations such as the International Monetary Fund (IMF), the European Commission (EC) and the European Central Bank (ECB) as one of the main drawbacks of Eurozone's periphery relative to Eurozone's core. Fig. 2 plots the competitiveness measure which shows

[4] We do not account for watch positive and watch negative outlooks for two reasons. First, we assume that the positive (negative) outlook is conceptually very close to watch positive (watch negative) outlook and, second, the number of watch positive and watch negative observations in our dataset is very small and equal to 10 for Fitch and 15 for S&P's. Treating watches as outlooks makes no qualitative difference to the main results of our paper reported below (in Tables 2–4).

[5] See: http://info.worldbank.org/governance/wgi/pdf/rq.pdf.

[6] This is the harmonised competitiveness indicator based on unit labour costs indices for the total economy; available from: https://www.ecb.europa.eu/stats/ecb_statistics/escb/html/table.en.html?id=JDF_EXR_HCI_ULCT&period=index.

Table 1
Linear transformation of sovereign ratings.

	Rating Agency				Frequency			Rating Grades
	Fitch	S&P's	Moody's	Outlook	Fitch	S&P's	Moody's	(1 –2 1)
Highest quality	AAA	AAA	Aaa	Stable	90	75	86	21
				Negative	4	10	9	20.67
				Positive	–	1	–	20.33
	AA+	AA+	Aa1	Stable	9	15	9	20
				Negative	1	4	5	19.67
				Positive	–	–	3	19.33
High quality	AA	AA	Aa2	Stable	20	10	19	19
				Negative	8	10	1	18.67
				Positive	2	–	3	18.33
	AA-	AA-	Aa3	Stable	5	11	6	18
				Negative	6	4	3	17.67
				Positive	5	1	5	17.33
	A+	A+	A1	Stable	21	13	25	17
				Negative	3	3	4	16.67
				Positive	9	5	4	16.33
Strong payment capacity	A	A	A2	Stable	14	29	14	16
				Negative	1	8	5	15.67
				Positive	5	2	4	15.33
	A-	A-	A3	Stable	9	12	11	15
				Negative	3	3	3	14.67
				Positive	2	4	2	14.33
	BBB+	BBB+	Baa1	Stable	10	6	7	14
				Negative	7	4	2	13.67
Adequate payment capacity				Positive	4	4	3	13.33
	BBB	BBB	Baa2	Stable	5	5	2	13
				Negative	3	4	3	12.67
				Positive	1	–	2	12.33
	BBB-	BBB-	Baa3	Stable	1	3	3	12
				Negative	2	3	3	11.67
				Positive	–	1	–	11.33
	BB+	BB+	Ba1	Stable	3	2	5	11
				Negative	4	1	3	10.67
Likely to fullfill obligations, ongoing uncertainty				Positive	–	–	–	10.33
	BB	BB	Ba2	Stable	–	1	–	10
				Negative	–	3	1	9.67
				Positive	–	1	–	9.33
	BB-	BB-	Ba3	Stable	–	–	1	9
				Negative	1	–	1	8.67
				Positive	–	–	–	8.33
	B+	B+	B1	Stable	1	1	1	8
				Negative	–	–	–	7.67
				Positive	–	–	–	7.33
High credit risk	B	B	B2	Stable	1	1	–	7
				Negative	–	–	–	6.67
				Positive	1	–	–	6.33
	B-	B-	B3	Stable	1	3	1	6
				Negative	1	–	1	5.67
				Positive	–	–	–	5.33
	CCC+	CCC+	Caa1	Stable	–	1	1	5
				Negative	–	1	–	4.67
				Positive	–	–	–	4.33
Very high credit risk	CCC	CCC	Caa2	Stable	4	–	–	4
				Negative	–	–	–	3.67
				Positive	–	–	–	3.33
	CCC-	CCC-	Caa3	Stable	–	–	2	3
				Negative	–	–	1	2.66
Non default wih possibility of recovery Default	CC	CC	Ca		–	–	–	2.33
	C				–	2	1	2
	DDD	SD	C					
	DD	D			–	–	1	1
	D							

a fair amount of cross-sectional variation with Slovakia and Estonia lagging behind and Germany consistently outperforming the rest of the countries (Ireland caught up with Germany at the end of the sample).

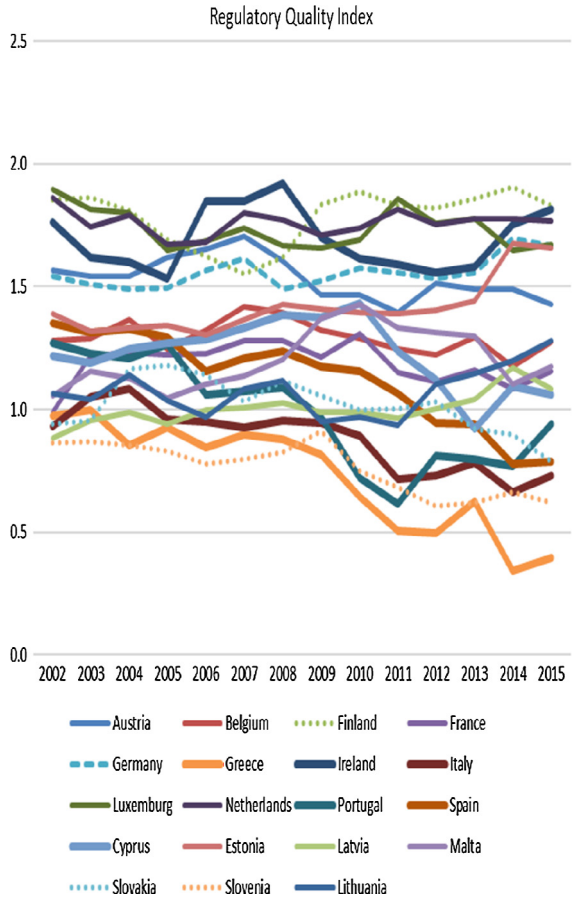

Fig. 1. Regulatory quality index for the Eurozone countries.

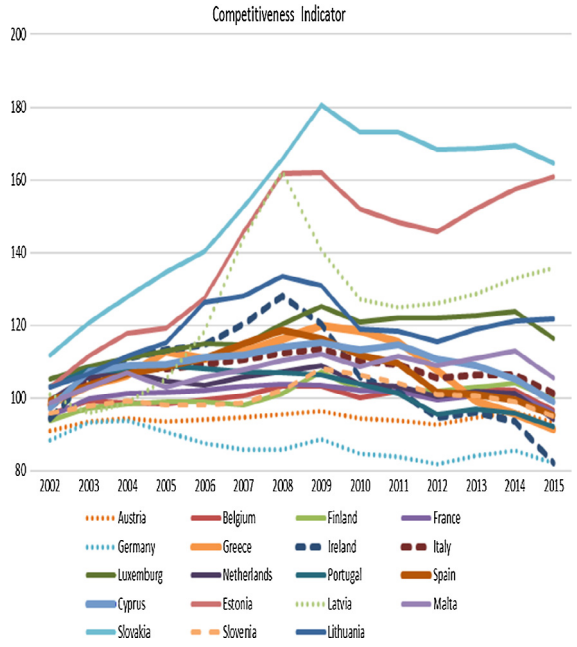

Fig. 2. Competitiveness indicator for the Eurozone countries. Notes: Competitiveness indicator 1999 = 100.

The second explanatory variable is the European Policy Uncertainty Index. This captures the impact of uncertainty, generally on the behaviour of rating agencies over time and more specifically on the cumulative downgrades of periphery's bonds during the recent Eurozone sovereign debt crisis. The index is constructed based on newspaper articles regarding policy uncertainty from 10 leading European newspapers. It counts the number of newspaper articles containing the terms uncertain or uncertainty, economic or economy, and one or more policy-relevant terms; for more information see Baker et al. (2016) and http://www.policyuncertainty.com/index.html. European policy uncertainty is expected to exert a negative impact on credit ratings. This is because higher uncertainty worsens the economic environment, makes consumers and investors more cautious and reduces future consumption and investment. Appendix Table A.1 provides details on our data definitions and sources of the dataset discussed here as well as details of all other variables used in the robustness Section 4.3 of the paper. Appendix Table A.2 provides the summary statistics for our dataset.

The main empirical results of the paper (reported in Section 4.1 below) rely on the eight control variables reported above. Our sample covers both the pre-crisis and the post-crisis period. Pre-crisis as well as post-crisis, monetary policy has been playing an important and further increasing role for the credit ratings of the euro area member states. Pre-crisis the ratings of the later crisis-affected countries might have been strongly biased upwards by low-cost credit provision linked to substantial ECB interest rate cuts in response to the post-2000 stock market slump.[7] In some countries, fast growing government expenditure has boosted unsustainable credit growth, which dramatically raised tax revenues. In the long run, the latter became a major reason for the crisis. Post-crisis, the increasingly loose monetary policy stance of the ECB aimed at stabilising the economic performance of the crisis-affected countries while, at the same time, fiscal tightening has put a drag on economic recovery. We take a closer look at some of these issues in Section 4.2 of the paper. But before doing so, we outline, in Section 3, our methodology.

3. Methodology

Quantile regression is appropriate when the variables of interest have varying effects at different points of the conditional distribution of the outcome variable. There has been a growing literature that combines quantile estimation with panel data. In mean regression, panel data allow for the inclusion of fixed effects to capture within group variation. Many quantile panel data estimators use an analogous method and include additive fixed effects. However, the additive fixed effects change the underlying model. We implement the quantile regression estimator for panel data (QRPD) with nonadditive fixed effects introduced by Powell (2016).

The main advantage of this method relative to the existing quantile estimators with additive fixed effects (α_i) is that it provides estimates of the distribution of Y_{it} given D_{it} instead of $Y_{it} - \alpha_i$ given D_{it}.[8]

Powell (2016) notes that in many empirical applications the latter is undesirable. This is because observations at the top of the ($Y_{it} - \alpha_i$) distribution may be at the bottom of the Y_{it} distribution and therefore additive fixed effect models cannot provide information about the effects of the policy variables on the outcome distribution. Thus, Powell's (2016) method provides point estimates which can be interpreted in the same way as the ones coming from cross-sectional regression. It is also consistent for small T. The underlying model is:

$$Y_{it} = \sum_{j=1}^{8} D'_{it}\beta_j(U^*_{it}), \tag{1}$$

where Y_{it} is the sovereign credit rating for each CRA, β_j is the parameter of interest, D_{it} is the set of explanatory variables and U^*_{it} is the error term that may be a function of several disturbance terms, some fixed and some time-varying. The model is linear in parameters and $D'_{it}\beta(\tau)$ is strictly increasing in τ. In general, for the τ^{th} quantile of Y_{it}, quantile regression relies on the conditional restriction:

$$P(Y_{it} \leqslant D'_{it}\beta(\tau)\big|D_{it}) = \tau \tag{2}$$

Eq. (2) states that the probability the outcome variable is smaller than the quantile function is the same for all D_{it} and equal to τ. Powell's (2016) QRPD estimator allows this probability to vary by individual and even within-individual as long as such variation is orthogonal to the instruments. Thus, QRPD relies on a conditional restriction and an unconditional restriction, letting $D_i = (D_{i1}, \ldots, D_{iT})$:

$$\begin{aligned} &P(Y_{it} \leqslant D'_{it}\beta(\tau)\big|D_i) = P(Y_{is} \leqslant D'_{is}\beta(\tau)\big|D_i), \\ &P(Y_{it} \leqslant D'_{it}\beta(\tau)) = \tau \end{aligned} \tag{3}$$

[7] For instance, the discount rate for the Euro area fell from 5.75% in late 2000 to 3% in late 2005.

[8] That is due to the different structural quantile functions (SQF). The SQF of QRPD is $d'\beta(\tau)$. In contrast, the SQF of models using additive fixed effects is $\alpha_i + d'\bar{\beta}(\bar{\tau})$ where d denotes potential values of D_{it} and τ is the relevant quantile of Y_{it}. The notation $\bar{\beta}(\bar{\tau})$ for the additive fixed effect model is used to highlight that these parameters are different than those used in the nonadditive fixed effects model.

Powell (2016) develops the estimator in an instrumental variables context given instruments $Z_i = (Z_{i1}, \ldots, Z_{iT})$ but notes that if the explanatory variables are exogenous (in which case $D_i = Z_i$) many of the identification conditions are met trivially. Estimation uses Generalized Method of Moments. Sample moments are defined as:

$$\hat{g}(b) = \frac{1}{N}\sum_{i=1}^{N} g_i(b) \text{ with } g_i(b) = \frac{1}{T}\left\{\sum_{i=1}^{T}(Z_{it} - \overline{Z_i})[1(Y_{it} \leqslant D_{it}'b)]\right\}, \tag{4}$$

where $\overline{Z_i} = \frac{1}{T}\sum_{i=1}^{T} Z_{it}$.

Using (3), the parameter set is defined as:

$$B \equiv \left\{ b \left| \tau - \frac{1}{N} \leqslant \frac{1}{N}\sum_{i=1}^{N} 1(Y_{it} \leqslant D_{it}'b) \leqslant \tau \right.\right\} \text{ for all } t. \tag{5}$$

Then, the parameter of interest is estimated as

$$\hat{\beta}(\tau) = \arg\min_{b\in\beta} \hat{g}'(b)\hat{A}\hat{g}(b) \tag{6}$$

for some weighting matrix $\hat{A}$. The model is estimated using the Markov Chain Monte Carlo (MCMC) optimization method.[9]

4. Empirical results

4.1. Main estimates

We capture the varying effects on credit ratings by estimating the model for the 0.05, 0.10, 0.15, …, 0.75 quantiles for each of the three CRAs (the model also estimates time fixed effects). Appendix Figs. A1–A3 map the sovereign credit ratings to the quantile distribution for the three CRAs. Almost 25% of the observations are in the highest quality AAA. That is the reason why 0.75 is the highest quantile we employ in this paper. Table A.3 provides information on the countries considered in each quantile per year; these should be read together with Table 1.[10]

To deal with the small sample bias, we report throughout the paper bootstrapped *p*-values based on 1000 replications and discuss (in Section 4.3) a large number of robustness checks that we feel go some way towards supporting our main results reported in this section of the paper.

In order to control for potential endogeneity (credit ratings can for instance have an impact on current account positions or government debt levels) we re-run the same model treating all explanatory variables as endogenous and using first-order lags as instruments. Estimated results (reported in appendix Tables A.4–A.6) are similar to those reported below.

Tables 2–4 report estimated coefficients, associated bootstrapped *p*-values, the pseudo-R^2 and the Akaike Information Criterion (AIC) for each quantile and each CRA. All explanatory variables have the expected signs and are statistically significant at almost all quantiles. The impact of the unemployment rate, regulatory quality and competitiveness is stronger at low ratings. For instance, the coefficient of the unemployment rate reduces from −0.4446 at the 0.05 quantile to −0.2201 at the 0.35 quantile and then to −0.0069 at the 0.75 quantile for Fitch. The estimates for Moody's and S&P's follow a similar pattern. Based on the quantile distribution, the impact of an improvement in regulatory quality on credit ratings is almost two times higher for counties rated at A1 and below for Moody's than those rated at Aa3 and almost 8 times higher than those rated at Aa1 or Aaa. Additionally, *ceteris paribus*, an annual decrease in the cost competiveness index by seven points of the index (such a move is not unusual in our dataset) brings about one half (≈7∗0.0687) of a notch upgrade at the 0.05 quantile for S&P's, one quarter (≈7∗0.0324) of a notch upgrade at the 0.35 and only 0.05 (≈7∗0.0061) of a notch upgrade at the 0.75 quantile. The impact of government debt on credit ratings is almost equally important for countries rated at adequate payment capacity and below and for those rated at high and highest quality, but impressively enough, is less strong for countries rated at strong payment capacity (that is, A1, A2, and A3 ratings for Moody's, and A+, A, and A- ratings for S&P's and Fitch) for all three CRAs. For example, the coefficient of Government Debt for S&P's is −0.0398 at the 0.15 quantile, −0.0370 at the 0.70 quantile but only −0.0209 and −0.0069 at the 0.45 and 0.50 quantiles, respectively.

CRAs attribute a higher weight on GDP per capita[11] for high rated countries; the impact of GDP per capita on sovereign credit rating is almost five times higher for the 0.65 quantile relative to the 0.15 one and almost two times higher relative to the 0.30 and 0.35 quantiles for Fitch. Therefore, the high level of GDP per capita provides a 'safety net' protecting (to some extent) from downgrades in the case of high rated countries.

[9] All estimations are done in STATA using David Powell's quantile estimator with nonadditive fixed effects available at: https://sites.google.com/site/davidmatthewpowell/quantile-regression-with-nonadditive-fixed-effects.

[10] Quantile coefficients tell us the effects on distributions and not on individuals (see e.g. Angrist and Pischke, 2009). Quantile regression estimates require linear programming methods, are more robust to outliers compared to OLS and avoid assumptions about the parametric distribution of the error process.

[11] Moody's GDP per capita coefficients at the 0.05 and 0.10 part of the distribution are counter-intuitive as is the S&P's GDP per capita coefficient at the 0.05 one. This, however, does not apply to Fitch. One possibility for this result is that countries at this very low part of the distribution, mainly Greece after 2010 and Cyprus after 2012, have witnessed persistent recession in the second half of the sample.

Table 2
Estimates for Moody's, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Moody's rating																		
0.05	−**1.1960**	0.000	−**0.0264**	0.000	**0.1159**	0.000	**0.2609**	0.000	−**0.3202**	0.000	**4.3321**	0.000	−**0.0467**	0.000	−**0.0325**	0.000	9.207	0.585
0.10	−**0.6623**	0.000	−**0.0384**	0.000	**0.0604**	0.000	**0.0332**	0.000	−**0.3341**	0.000	**4.3158**	0.000	−**0.0360**	0.000	−**0.0158**	0.000	9.072	0.594
0.15	**0.6975**	0.000	−**0.0370**	0.000	**0.0077**	0.000	−**0.0027**	0.000	−**0.2744**	0.000	**4.1139**	0.000	−**0.0349**	0.000	−**0.0119**	0.000	8.804	0.608
0.20	**3.1277**	0.000	−**0.0387**	0.000	−**0.0508**	0.000	0.0034	0.864	−**0.2400**	0.000	**4.1229**	0.000	−**0.0313**	0.000	−**0.0117**	0.000	8.049	0.627
0.25	**4.6216**	0.000	−**0.0449**	0.000	−**0.0196**	0.014	−**0.0680**	0.000	−**0.1907**	0.000	**3.3931**	0.000	−**0.0329**	0.000	−**0.0175**	0.000	7.426	0.639
0.30	**5.4820**	0.000	−**0.0372**	0.000	−**0.0377**	0.000	0.0410	0.203	−**0.1181**	0.000	**4.1231**	0.000	−**0.0341**	0.000	−**0.0109**	0.000	7.528	0.625
0.35	**4.8628**	0.000	−**0.0412**	0.000	−**0.1542**	0.011	−**0.1530**	0.024	−**0.1286**	0.000	**3.2106**	0.000	−**0.0251**	0.000	−**0.0307**	0.000	7.345	0.575
0.40	**3.3678**	0.000	−**0.0082**	0.000	−**0.0739**	0.001	0.0221	0.576	−**0.2136**	0.000	**4.4561**	0.000	−**0.0484**	0.000	−**0.0136**	0.000	7.884	0.584
0.45	**4.3645**	0.000	0.0089	0.153	−**0.0789**	0.000	−0.0111	0.694	−**0.2083**	0.000	**4.0718**	0.000	−**0.0294**	0.000	−**0.0191**	0.000	7.092	0.533
0.50	**3.7006**	0.000	0.0032	0.337	−**0.0226**	0.000	−**0.1233**	0.000	−**0.2119**	0.000	**2.4526**	0.000	−**0.0156**	0.000	−**0.0140**	0.000	7.505	0.554
0.55	**4.4081**	0.000	−**0.0097**	0.000	**0.0050**	0.029	−**0.0834**	0.000	−**0.2319**	0.000	**1.6651**	0.000	−**0.0325**	0.000	−**0.0158**	0.000	7.621	0.589
0.60	**6.7502**	0.000	−**0.0272**	0.000	−**0.0347**	0.056	0.0363	0.213	−**0.2010**	0.000	**1.9421**	0.000	−**0.0263**	0.000	−**0.0062**	0.001	8.069	0.627
0.65	**6.9493**	0.000	−**0.0168**	0.000	−**0.0641**	0.000	−**0.2221**	0.000	−**0.2727**	0.000	**0.6950**	0.000	0.0036	0.656	**0.0091**	0.070	8.414	0.519
0.70	**8.4967**	0.000	−**0.0246**	0.000	−**0.0411**	0.000	−**0.1600**	0.000	−0.0403	0.163	**0.9713**	0.001	−**0.0100**	0.000	−**0.0042**	0.000	8.736	0.519
0.75	**9.7634**	0.000	−**0.0308**	0.000	−**0.0263**	0.025	−**0.1112**	0.011	0.0133	0.629	0.3437	0.180	−**0.0201**	0.000	−**0.0076**	0.002	8.889	0.495

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table 3
Estimates for S&P's, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: S&P's rating																		
0.05	−**0.1961**	0.000	−**0.0277**	0.000	**0.0565**	0.000	**0.0361**	0.000	−**0.3655**	0.000	**5.0575**	0.000	−**0.0687**	0.000	−**0.0219**	0.000	9.101	0.620
0.10	**2.7722**	0.000	−**0.0316**	0.000	**0.0156**	0.000	−**0.0336**	0.000	−**0.2247**	0.000	**3.3226**	0.000	−**0.0539**	0.000	−**0.0112**	0.000	8.414	0.663
0.15	**4.1889**	0.000	−**0.0398**	0.000	**0.0424**	0.000	−**0.1598**	0.000	−**0.2510**	0.000	**1.8446**	0.000	−**0.0417**	0.000	−**0.0118**	0.000	8.019	0.681
0.20	**4.8046**	0.000	−**0.0293**	0.000	**0.0194**	0.049	−**0.1416**	0.000	−**0.2487**	0.000	**2.7552**	0.000	−**0.0328**	0.000	−**0.0206**	0.000	7.397	0.684
0.25	**3.2558**	0.000	−**0.0237**	0.000	**0.0540**	0.000	−**0.1174**	0.000	−**0.2821**	0.000	**2.6147**	0.000	−**0.0420**	0.000	−**0.0159**	0.000	8.292	0.675
0.30	**4.5407**	0.000	−**0.0277**	0.000	**0.0555**	0.000	−**0.0873**	0.000	−**0.2470**	0.000	**2.4303**	0.000	−**0.0439**	0.000	−**0.0109**	0.000	7.616	0.682
0.35	**5.6193**	0.000	−**0.0402**	0.000	−**0.0202**	0.035	−**0.2705**	0.000	−**0.2713**	0.000	**2.3127**	0.000	−**0.0324**	0.000	−**0.0151**	0.000	6.908	0.683
0.40	**6.2628**	0.000	−**0.0270**	0.000	0.0083	0.303	−**0.1976**	0.000	−**0.2361**	0.000	**1.7445**	0.000	−**0.0275**	0.000	−**0.0129**	0.000	7.490	0.687
0.45	**6.5806**	0.000	−**0.0209**	0.000	**0.0130**	0.003	−**0.1212**	0.000	−**0.2405**	0.000	**1.3283**	0.000	−**0.0275**	0.000	−**0.0066**	0.000	7.834	0.670
0.50	**5.4772**	0.000	−**0.0069**	0.046	−0.0419	0.308	−**0.1020**	0.000	−**0.2703**	0.000	**1.0692**	0.000	−0.0041	0.169	−**0.0153**	0.000	7.345	0.636
0.55	**8.1589**	0.000	−**0.0373**	0.000	−**0.0568**	0.029	−**0.0810**	0.000	−**0.2010**	0.000	**1.6103**	0.000	−**0.0191**	0.000	0.0007	0.810	8.576	0.671
0.60	**8.3574**	0.000	−**0.0200**	0.000	−0.0129	0.315	0.0264	0.686	−**0.1562**	0.000	**0.4308**	0.072	**0.0118**	0.000	−**0.0109**	0.000	8.727	0.645
0.65	**8.8327**	0.000	−**0.0211**	0.000	−**0.0524**	0.001	−**0.3271**	0.000	−**0.2436**	0.000	**1.1058**	0.000	0.0036	0.360	**0.0137**	0.000	8.896	0.567
0.70	**11.1976**	0.000	−**0.0370**	0.000	−**0.0311**	0.007	−0.0352	0.245	−**0.0564**	0.000	−0.2596	0.417	0.0009	0.460	−**0.0085**	0.000	9.133	0.619
0.75	**12.6666**	0.000	−**0.0429**	0.000	−0.0292	0.105	−**0.0962**	0.005	0.0169	0.359	0.1282	0.343	−**0.0061**	0.009	−**0.0064**	0.089	9.316	0.591

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table 4
Estimates for Fitch, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Fitch rating																		
0.05	**0.8393**	0.000	**−0.0237**	0.000	**0.0960**	0.000	**−0.0463**	0.000	**−0.4446**	0.000	**1.2453**	0.000	**−0.0509**	0.000	**−0.0317**	0.000	9.116	0.577
0.10	**0.7370**	0.000	**−0.0179**	0.000	**0.0765**	0.000	**−0.1005**	0.000	**−0.4457**	0.000	**2.8360**	0.000	**−0.0389**	0.000	**−0.0115**	0.000	8.911	0.633
0.15	**2.3524**	0.000	**−0.0253**	0.000	**0.0583**	0.000	**−0.1070**	0.000	**−0.4223**	0.000	**2.7182**	0.000	**−0.0419**	0.000	**−0.0053**	0.000	8.563	0.651
0.20	**3.4014**	0.000	**−0.0203**	0.000	**0.0433**	0.000	**−0.1092**	0.000	**−0.3287**	0.000	**2.6176**	0.000	**−0.0421**	0.000	**−0.0107**	0.000	8.214	0.663
0.25	**6.5064**	0.000	**−0.0294**	0.000	−0.0045	0.442	**−0.1364**	0.000	**−0.3004**	0.000	**1.6866**	0.000	**−0.0488**	0.000	**−0.0093**	0.000	7.198	0.669
0.30	**4.7267**	0.000	**−0.0554**	0.000	**0.0523**	0.019	**−0.2287**	0.000	**−0.3111**	0.000	**1.3404**	0.000	**−0.0381**	0.000	0.0040	0.441	7.729	0.634
0.35	**5.6993**	0.000	**−0.0074**	0.000	**−0.0179**	0.006	**−0.0578**	0.000	**−0.2201**	0.000	**2.2305**	0.000	**−0.0370**	0.000	**−0.0118**	0.000	7.267	0.635
0.40	**6.5795**	0.000	**−0.0120**	0.000	**−0.0386**	0.000	**−0.1348**	0.000	**−0.1908**	0.000	**2.3079**	0.000	**−0.0388**	0.000	**−0.0152**	0.000	7.794	0.633
0.45	**6.1085**	0.000	**−0.0122**	0.000	**−0.0202**	0.000	**−0.0288**	0.035	**−0.2246**	0.000	**2.7174**	0.000	**−0.0402**	0.000	**−0.0098**	0.000	7.632	0.647
0.50	**5.4025**	0.000	**−0.0128**	0.000	−0.0241	0.144	**−0.1071**	0.000	**−0.2603**	0.000	**2.5984**	0.000	**−0.0315**	0.000	0.0049	0.201	7.495	0.630
0.55	**5.2451**	0.000	**−0.0092**	0.001	0.0082	0.309	−0.0148	0.259	**−0.2261**	0.000	**2.3528**	0.000	**−0.0221**	0.000	**−0.0077**	0.000	7.297	0.660
0.60	**9.3137**	0.000	**−0.0249**	0.000	**−0.0217**	0.000	**−0.0429**	0.000	**−0.1646**	0.000	**0.1749**	0.006	**−0.0177**	0.000	**−0.0010**	0.097	8.789	0.632
0.65	**10.1534**	0.000	**−0.0262**	0.000	**−0.0306**	0.000	**−0.0698**	0.000	**−0.1308**	0.000	**0.6065**	0.000	**−0.0091**	0.000	0.0009	0.667	9.021	0.616
0.70	**9.1753**	0.000	**−0.0292**	0.000	**−0.0575**	0.000	**−0.1863**	0.000	**−0.0706**	0.000	**0.8319**	0.000	**−0.0133**	0.000	0.0006	0.832	8.843	0.595
0.75	**11.8393**	0.000	**−0.0379**	0.000	**−0.0449**	0.000	**−0.1528**	0.000	−0.0069	0.193	**−0.7012**	0.000	**−0.0181**	0.000	0.0025	0.132	9.182	0.498

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

The significance of inflation rate varies across the rating distribution but without any specific trend pattern. Economic policy uncertainty impacts negatively on credit ratings across the quantile distribution and the impact is stronger on the lower rated countries; in other words, when European uncertainty kicks in, low rated countries take a much bigger 'hit' than high rated countries. Further, the uncertainty effect is stronger for Moody's and weaker for Fitch at all quantiles.

The impact of the current account balance is positive at the 0.05, 0.10 and 0.15 quantiles for all agencies and remains positive at the 0.20, 0.25, and 0.30 quantiles for S&P's and at the 0.20 and 0.30 quantiles for Fitch. The impact of the current account turns negative at all other quantiles for all CRAs. Hence, we find an asymmetric impact of the current account over the quantile distribution of sovereign ratings. Noting that the impact of current account balance on sovereign credit ratings is theoretically uncertain, our analysis shows that a reduction in the current account deficit or an increase in the current account surplus leads to a rating or outlook upgrade for low rated countries which have historically recorded high current account deficits.[12] The effect is entirely different for countries with strong payment capacity, high and highest quality. In this case, a higher current account deficit or a lower current account surplus is associated with either higher creditworthiness or positive economic prospects of the economy and consequently a higher sovereign rating (Afonso et al., 2011). But why low rated countries (namely the GIIPS and Cyprus) are downgraded when they record higher current account deficits? Recalling that current account deficits reflect net borrowing from abroad, one might argue that there is nothing intrinsically wrong with current account imbalances if countries borrow from abroad to invest in capacity which consequently allows them to satisfy their debt obligations. Rather than doing this, Eurozone's periphery funds from abroad largely ended up in non-traded sectors (like government consumption and housing); see, for instance, the discussion in Baldwin and Giavazzi (2015).[13]

In the preliminary analysis we added the growth rate of GDP as an extra explanatory variable but found very weak evidence of a positive and statistically significant impact on credit ratings; this might have to do with the persistently weak GDP growth rates observed in the Euro area over the recent years. Arguably, however, the impact of GDP growth on credit ratings is indirectly captured by the impact of the unemployment rate through an Okun's-law type of approximation (in which case there is an inverse relationship between unemployment and GDP growth).

4.2. Incorporating the interaction of fiscal and monetary policy

Fiscal discipline has been on the agenda of policymakers in the Euro area after 2009. Fiscal balance to-GDP-ratio was not a major concern for CRAs in making credit rating decisions for developed countries until the recent Eurozone debt crisis; Reusens and Croux (2017) identify a significant positive effect from the fiscal balance-to-GDP ratio on credit ratings only after 2009. In our case, we could only find some statistical evidence using the lagged fiscal balance-to-GDP ratio as an explanatory variable. Arguably, such a finding has to do with continuous revisions in the fiscal balance variable as well as the disagreement between authorities not only on the predicted fiscal balance but also on the actual outcome[14,15]; to this end, we mention the study of De Castro et al. (2013) who find that most preliminary European Union government balance data releases "are biased and non efficient predictors of subsequent releases, with later vintages of data tending to show lower budget balances than indicated by earlier data releases on average" (De Castro et al., 2013, page 1207). In light of this, CRAs might have been reluctant to monitor current fiscal balance for credit rating decisions which, in turn, might explain why lagged fiscal balance might play more of a role.[16]

That said, pre-crisis government budget balances and thereby government debt did not indicate growing risk in GIIPS and Cyprus. The reason is that the unsustainable speculation booms due to low-cost credit provision linked to substantial ECB interest rate cuts in response to the post-2000 stock market slump created windfall tax revenues, which made budget balances and government debt look sound. This, rather than the statistical revisions mentioned above, could explain why the fiscal balance-to-GDP ratios (i.e. the Maastricht criterion) are not related to credit ratings (see Schnabl and Wollmershäuser, 2013). With this in mind, we added government expenditure in our model as an additional explanatory variable, with growing expenditure being linked to higher risk. To identify the full impact of government debt on ratings, the impact of unconventional monetary policy on government bond yields has to be controlled for. Therefore, we re-run the models reported in Tables 2–4 using the general government expenditure-to-GDP ratio and a measure of unconventional monetary policy as additional regressors. To capture unconventional monetary policy effects we use (a) the ECB purchases and holdings of securities for monetary policy purposes as a percentage of Eurozone GDP (see the discussion in Lo Duca et al., 2016) and, alternatively, (b) the ECB total balance sheet assets as a percentage of GDP; expansion of the latter is often quoted by the financial

[12] Over 2002–2015, Greece recorded an average current account deficit of 7.61% as a share of its GDP. The corresponding deficit figures for Ireland, Italy, Portugal, Spain and Cyprus were 0.85%, 0.87%, 6.63%, 4.02% and 6.45%. By contrast, the Euro area recorded an average current account surplus of 0.71% as a share of its GDP.

[13] The correlation between the current account variable and the competitiveness indicator is only -0.28 which eases any multicollinearity concerns. In any case, we have re-estimated the models in Tables 2–4 by dropping competitiveness. This made no qualitative difference to the estimates on the remaining variables (including the current account). Dropping the current account variable made no difference to the empirical estimates on the remaining variables (including competitiveness).

[14] See, for instance: http://www.reuters.com/article/us-eu-deficits-idUSTRE63L1G420100422.

[15] See: http://ec.europa.eu/info/files/winter-2017-economic-forecast-greece_en.

[16] Our results (available on request) suggest that there is a positive effect of the lagged fiscal balance throughout the distribution for Moody's, whereas, for S&P's and Fitch, we find a negative effect at the 0.10 and 0.15 quantiles of distribution (estimates on the remaining variables are qualitatively similar to what we report in Tables 2–4).

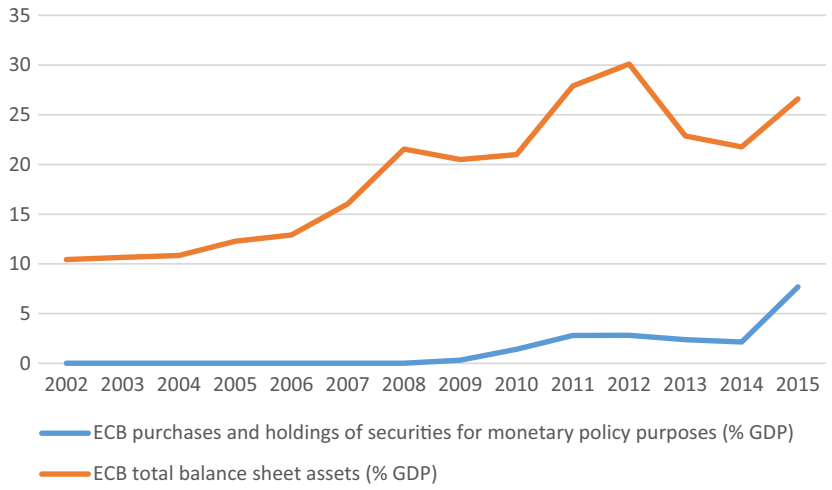

Fig. 3. Unconventional monetary policy measures. Note: Data retrieved from Source: ECB website at: http://sdw.ecb.europa.eu/ and https://www.ecb.europa.eu/pub/annual/balance/html/index.en.html.

press as a proxy for unconventional policies (see e.g. Davies, 2017). From Fig. 3, the ECB purchases and holdings of securities, which started in 2009, reached 7.68% of Eurozone GDP in 2015 whereas the ECB total balance sheet assets expanded from 10.44% of Eurozone GDP in 2002 to 26.60% in 2015.

Our regressions (available on request) failed to identify a statistically significant negative economic impact of government expenditure on credit ratings. [17] We also note the high correlation between economic policy uncertainty and the ECB purchases and holdings of securities for monetary policy purposes as a percentage of Eurozone GDP (this is equal to 0.62) and the high correlation between economic policy uncertainty and the ECB total balance sheet assets as a percentage of Eurozone GDP (this is equal to 0.80). These high correlations raised considerable multicollinearity concerns in our estimated regressions. With this in mind, we re-run the models reported in Tables 2–4 by dropping economic policy uncertainty as a regressor and using instead unconventional monetary policy. Tables 5–7 report our results using ECB's purchases and holdings of securities for monetary policy purposes as a percentage of Eurozone GDP. We treat all explanatory variables as endogenous and use first-order lags as instruments to account for possible endogeneity issues; this is particularly desirable if one is willing to assume that following a number of credit rating downgrades, which put an upward pressure on sovereign ratings, ECB responded by authorising (additional) monetary easing.

From Tables 5–7, we find a negative and statistically significant effect for the ECB variable throughout the credit rating distribution. To save space, we do not report our estimates using as explanatory variable the ECB total balance sheet assets as percentage of Eurozone GDP but we note that the impact of the latter variable is also negative and statistically significant (detailed results are available on request). To further explore the possible endogeneity between credit ratings and ECB easing, we have used instead lagged ECB purchases and holdings of securities or lagged ECB total balance sheet assets as regressors. Even in this case, the impact of both variables remains negative and statistically significant. We have also pursued this issue further by employing, as regressors: (a) changes in ECB purchases and holdings of securities (and using lagged changes as instruments), or (b) lagged changes in ECB purchases and holdings of securities, or (c) changes in ECB total balance sheet assets (and using lagged changes as instruments), or (d) lagged changes in ECB total balance sheet assets. Even in all these cases, the negative effect of the above mentioned variables on credit ratings remains dominant (but some of these effects turn out to be statistically insignificant).

If one is willing to assume that unconventional monetary policy provides a 'signal' that Eurozone's economic recovery is (at best) shaky, CRAs might arguably be less likely to proceed with sovereign upgrades when monetary easing is adopted. Admittedly, this argument provides some justification on why we fail to find a positive effect from monetary easing on ratings. As a number of studies have already documented (see e.g. Kinateder and Wagner, forthcoming; De Santis, 2016 and Koijen et al., 2016), unconventional monetary easing has lowered sovereign yields directly, therefore bypassing the role of CRAs in affecting sovereign bond yield through their credit rating decisions. Among others, influential academic Taylor (2016) has warned that extra low (US) interest rates and unconventional monetary policy has brought on a risk-taking search for yield and excesses in the housing market; similar concerns apply to the Eurozone area where, for instance, a report by Moody's Analytics in 2015 also flagged concerns that rising prices and the ECB's monetary easing have caused the risk of house price bubbles to resurface. [18] Taylor (2016) went on to note that "these policies were not effective, and may have been

[17] Results do not change if we use instead the general government expenditure excluding interest payments-to-GDP ratio, the cyclically adjusted government expenditure-to-potential GDP ratio or the cyclically adjusted government expenditure excluding interest payments-to-potential GDP ratio.

[18] Available from: https://www.economy.com/dismal/analysis/free/255221/QE-Could-Fuel-Housing-Bubbles-in-Europe.

Table 5
Estimates for Moody's with first order lags as instrumental variables, 2002–2015. Model with ECB purchases and holdings of securities for monetary policy purposes as a percentage of Eurozone GDP.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		ECB Securities		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Moody's rating																		
0.05	−**0.0982**	0.002	−**0.0462**	0.000	**0.0573**	0.000	−**0.1620**	0.000	−**0.3852**	0.000	**3.2467**	0.000	−**0.0235**	0.000	−**0.6303**	0.000	9.132	0.586
0.10	**0.8461**	0.000	−**0.0533**	0.000	**0.0422**	0.000	−**0.1388**	0.000	−**0.3754**	0.000	**2.9814**	0.000	−**0.0402**	0.000	−**0.2783**	0.000	9.047	0.601
0.15	**0.7454**	0.000	−**0.0363**	0.000	**0.0243**	0.000	−**0.0786**	0.000	−**0.3060**	0.000	**3.3980**	0.000	−**0.0315**	0.000	−**0.3938**	0.000	8.932	0.616
0.20	**2.6789**	0.000	−**0.0401**	0.000	**0.0241**	0.000	0.0000	0.995	−**0.2671**	0.000	**3.3091**	0.000	−**0.0349**	0.000	−**0.2362**	0.000	8.421	0.632
0.25	**2.8139**	0.000	−**0.0335**	0.000	**0.0238**	0.001	−**0.0785**	0.000	−**0.2494**	0.000	**3.0454**	0.000	−**0.0420**	0.000	−**0.3585**	0.000	8.444	0.638
0.30	**12.1451**	0.000	−**0.0426**	0.000	−**0.1838**	0.000	−**0.2163**	0.000	−**0.0551**	0.061	**2.4439**	0.000	0.0044	0.551	−**0.4361**	0.000	9.488	0.577
0.35	**3.3152**	0.000	−**0.0293**	0.000	−**0.0998**	0.000	−**0.1871**	0.000	−**0.2773**	0.000	**5.6845**	0.000	−**0.0500**	0.000	−**0.4927**	0.000	8.032	0.618
0.40	**4.4521**	0.000	−**0.0124**	0.000	−0.0511	0.134	−0.0303	0.168	−**0.2144**	0.000	**3.6921**	0.004	−**0.0336**	0.000	−**0.4494**	0.000	7.152	0.614
0.45	**5.4926**	0.000	−**0.0155**	0.000	−**0.0347**	0.000	−**0.0535**	0.000	−**0.2175**	0.000	**2.7009**	0.000	−**0.0281**	0.000	−**0.4541**	0.000	7.668	0.622
0.50	**6.1522**	0.000	−**0.0161**	0.000	−**0.0303**	0.001	−**0.1145**	0.000	−**0.1686**	0.000	**1.5742**	0.000	−**0.0227**	0.000	−**0.2444**	0.000	8.046	0.601
0.55	**6.7348**	0.000	−**0.0197**	0.000	0.0217	0.194	−**0.1518**	0.000	−**0.1330**	0.000	0.2679	0.488	−**0.0120**	0.000	−**0.4158**	0.000	8.243	0.590
0.60	**2.9593**	0.000	−**0.0216**	0.000	**0.0919**	0.000	**0.0381**	0.042	−**0.3023**	0.000	**0.4427**	0.000	−**0.0333**	0.000	−**0.2245**	0.000	8.523	0.609
0.65	**8.7199**	0.000	−**0.0231**	0.000	−0.0012	0.858	−**0.1523**	0.000	−**0.0154**	0.013	**0.8722**	0.000	−**0.0067**	0.000	−**0.2019**	0.000	8.961	0.507
0.70	**8.6453**	0.000	−**0.0252**	0.000	−**0.0096**	0.052	−**0.1593**	0.000	**0.0262**	0.000	**0.8000**	0.000	−**0.0152**	0.000	−**0.1590**	0.000	8.915	0.472
0.75	**9.2649**	0.000	−**0.0309**	0.000	−0.0175	0.296	−**0.1238**	0.001	0.0167	0.448	0.4819	0.341	−**0.0222**	0.000	−**0.2185**	0.000	8.966	0.510

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table 6
Estimates for S&P's with first order lags as instrumental variables, 2002–2015. Model with ECB purchases and holdings of securities for monetary policy purposes as a percentage of Eurozone GDP.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		ECB Securities		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: S&P's rating																		
0.05	**2.3488**	0.000	−**0.0396**	0.000	−**0.0200**	0.000	−**0.1528**	0.000	−**0.2805**	0.000	**4.5861**	0.000	−**0.0655**	0.000	−**0.3183**	0.000	8.669	0.646
0.10	**2.7339**	0.000	−**0.0248**	0.000	**0.0541**	0.010	−**0.1251**	0.001	−**0.3126**	0.000	**2.5558**	0.000	−**0.0247**	0.004	−**0.1487**	0.001	8.344	0.678
0.15	**5.0821**	0.000	−**0.0417**	0.000	**0.0351**	0.007	−**0.2315**	0.000	−**0.2674**	0.000	**1.2803**	0.000	−**0.0414**	0.000	−**0.3438**	0.000	7.605	0.686
0.20	**3.8789**	0.000	−**0.0349**	0.000	**0.1057**	0.000	−**0.1163**	0.000	−**0.3140**	0.000	**1.3277**	0.000	−**0.0307**	0.000	−**0.3569**	0.000	8.157	0.680
0.25	**7.2055**	0.000	−**0.0384**	0.000	0.0000	0.997	−**0.2009**	0.000	−**0.3044**	0.000	**1.0621**	0.000	−**0.0459**	0.000	−**0.3554**	0.000	7.847	0.685
0.30	**5.1313**	0.000	−**0.0302**	0.000	**0.0686**	0.000	−**0.1631**	0.000	−**0.3114**	0.000	**1.4773**	0.000	−**0.0360**	0.000	−**0.3645**	0.000	7.323	0.688
0.35	**6.3830**	0.000	−**0.0328**	0.000	−0.0089	0.232	−**0.2273**	0.000	−**0.2879**	0.000	**1.6716**	0.000	−**0.0310**	0.000	−**0.3562**	0.000	7.716	0.691
0.40	**6.4706**	0.000	−**0.0296**	0.000	**0.0205**	0.000	−**0.2072**	0.000	−**0.2534**	0.000	**1.1738**	0.000	−**0.0416**	0.000	−**0.2879**	0.000	7.580	0.682
0.45	**6.6454**	0.000	−**0.0165**	0.000	−0.0287	0.415	−**0.2774**	0.000	−**0.2442**	0.000	**1.1038**	0.000	−0.0107	0.356	−**0.5076**	0.000	8.204	0.656
0.50	**4.8321**	0.000	−**0.0157**	0.000	−0.0013	0.903	−**0.3053**	0.000	−**0.2876**	0.000	**1.5721**	0.000	−**0.0252**	0.000	−0.0027	0.951	7.115	0.637
0.55	**6.6108**	0.000	−**0.0205**	0.000	**0.0177**	0.023	−**0.2885**	0.000	−**0.2428**	0.000	**2.0653**	0.000	−**0.0206**	0.000	−**0.0837**	0.000	8.229	0.658
0.60	**6.5480**	0.000	−**0.0262**	0.000	**0.0773**	0.000	−**0.1397**	0.000	−**0.3008**	0.000	−**0.3898**	0.038	**0.0038**	0.027	−**0.1696**	0.011	8.076	0.667
0.65	**9.8907**	0.000	−**0.0386**	0.000	0.0043	0.730	−**0.1887**	0.001	−**0.1119**	0.003	0.2450	0.328	−**0.0072**	0.034	−0.0952	0.338	9.069	0.650
0.70	**10.7908**	0.000	−**0.0411**	0.000	−0.0029	0.838	−**0.1798**	0.000	−**0.0540**	0.000	**0.2974**	0.060	−0.0045	0.124	−0.1388	0.329	9.234	0.632
0.75	**11.4688**	0.000	−**0.0425**	0.000	−**0.0298**	0.002	−**0.1026**	0.000	−**0.0428**	0.002	**0.7611**	0.000	−**0.0043**	0.056	−**0.1151**	0.000	9.350	0.630

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table 7
Estimates for Fitch with first order lags as instrumental variables, 2002–2015. Model with ECB purchases and holdings of securities for monetary policy purposes as a percentage of Eurozone GDP.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		ECB Securities		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Fitch rating																		
0.05	**1.7163**	0.000	**−0.0251**	0.000	**0.1804**	0.000	**0.0053**	0.000	**−0.5051**	0.000	**2.1308**	0.000	**−0.0257**	0.000	**−0.3806**	0.000	8.829	0.643
0.10	**1.5516**	0.000	**−0.0185**	0.000	**0.0845**	0.000	**−0.1458**	0.000	**−0.4745**	0.000	**1.9780**	0.000	**−0.0347**	0.000	**−0.3529**	0.000	8.896	0.647
0.15	**2.3024**	0.000	**−0.0197**	0.000	**0.0514**	0.000	**−0.1627**	0.000	**−0.4198**	0.000	**2.3990**	0.000	**−0.0346**	0.000	**−0.2739**	0.000	8.659	0.662
0.20	**2.2746**	0.000	**−0.0143**	0.000	**0.0359**	0.000	**−0.1745**	0.000	**−0.4454**	0.000	**2.3844**	0.000	**−0.0352**	0.000	**−0.3132**	0.000	8.670	0.655
0.25	**7.2327**	0.000	**−0.0297**	0.000	−0.0408	0.196	**−0.2433**	0.000	**−0.3469**	0.000	**2.4269**	0.000	**−0.0307**	0.000	**−0.3502**	0.000	8.251	0.685
0.30	**6.7367**	0.000	−0.0024	0.390	**−0.1072**	0.000	**−0.2955**	0.000	**−0.2713**	0.000	**3.7176**	0.000	**−0.0125**	0.029	**−0.2208**	0.000	8.565	0.629
0.35	**5.6190**	0.000	**−0.0194**	0.000	−0.0638	0.286	**−0.1444**	0.000	**−0.2413**	0.000	**1.4645**	0.001	−0.0226	0.349	**−0.4970**	0.050	7.423	0.646
0.40	**5.5656**	0.000	**−0.0148**	0.000	**0.0065**	0.000	**−0.1321**	0.000	**−0.2362**	0.000	**1.8662**	0.000	**−0.0464**	0.000	**−0.2098**	0.000	7.112	0.648
0.45	**5.2675**	0.000	−0.0011	0.449	**−0.0537**	0.000	**−0.0384**	0.036	**−0.2419**	0.000	**3.6886**	0.000	**−0.0389**	0.000	**−0.2627**	0.000	7.643	0.626
0.50	**5.9984**	0.000	**−0.0106**	0.001	0.0111	0.180	**−0.1772**	0.000	**−0.2450**	0.000	**1.9077**	0.000	**−0.0249**	0.000	**−0.1333**	0.000	7.900	0.649
0.55	**8.0614**	0.000	**−0.0220**	0.000	−0.0103	0.510	**−0.2066**	0.000	**−0.2386**	0.000	**1.3926**	0.000	**−0.0318**	0.000	−0.1055	0.223	8.579	0.652
0.60	**7.7209**	0.000	**−0.0234**	0.000	**0.0360**	0.002	0.0353	0.765	**−0.3313**	0.000	−1.2146	0.183	**0.0150**	0.027	0.1946	0.159	8.601	0.578
0.65	**8.2684**	0.000	**−0.0283**	0.000	**0.0232**	0.053	**−0.3122**	0.000	**−0.1182**	0.000	−0.0521	0.829	**−0.0127**	0.000	**−0.1840**	0.000	8.676	0.625
0.70	**8.5713**	0.000	**−0.0256**	0.000	**−0.0144**	0.002	**−0.1075**	0.000	**−0.0703**	0.000	**0.7421**	0.000	**−0.0185**	0.000	**−0.0626**	0.000	8.839	0.617
0.75	**9.5583**	0.000	**−0.0224**	0.000	**−0.0408**	0.000	**−0.2571**	0.000	**−0.0656**	0.000	**0.8387**	0.000	**−0.0043**	0.001	**−0.2532**	0.000	9.088	0.609

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

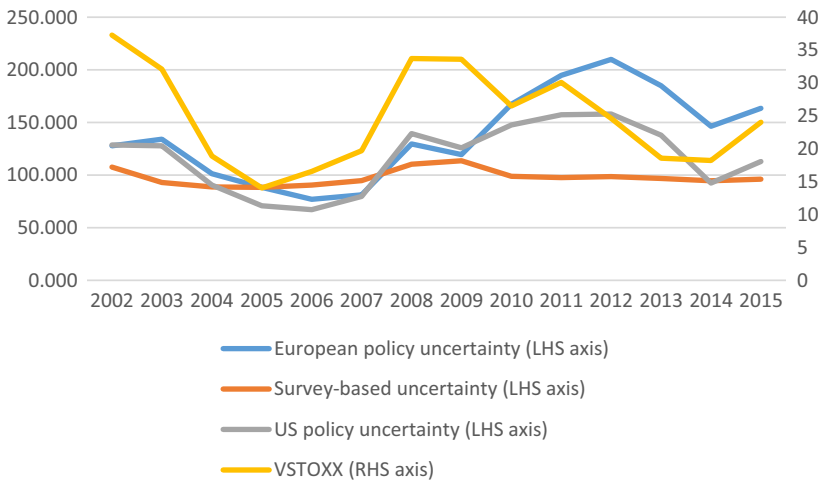

Fig. 4. Uncertainty measures. Note: The survey-based uncertainty comes from Girardi and Reuter (2017). European policy uncertainty and US policy uncertainty come from Baker et al. (2016). The VSTOXX measure is available from https://www.stoxx.com/index-details?symbol=V2TX.

counterproductive" (Taylor, 2016, p. 2; see also references therein). This is equally applicable to the Eurozone area where unconventional monetary policy has raised concerns that Eurozone countries have lost the appetite to proceed with structural reforms; see e.g. German Council of Economic Experts (2016), an issue also (and lively) debated by the November 2016 Centre for Macroeconomics Survey. [19] As unconventional monetary policies with near zero policy rates have been adopted by major central banks, Taylor (2016) proceeded with his criticism noting that "the international monetary system has deviated further from a sound rules-based system" which in turn has increased exchange rate volatility and has raised suspicions of "currency manipulation" (Taylor, 2016, p. 3).

To counteract (some of) these (huge) concerns, it is plausible that CRAs might have reacted by adopting, post 2009, a much more cautious approach than previously adopted, which would then justify a number of downgrades.

To the best of our knowledge, however, no other research paper has found a direct negative impact of unconventional monetary easing on Eurozone sovereign ratings. That said, we note the very fresh research by Reusens and Croux (2017) who find that after the start of the European debt crisis in 2009, the impact of Eurozone membership on sovereign credit rating decisions switched from positive to negative. The finding of Reusens and Croux (2017) is justified on the grounds that member countries in a monetary union are prone to a self-fulfilling liquidity crisis. This is because member countries cannot force the central bank to alleviate a liquidity crisis by buying their government debt; as a result, they can face higher borrowing costs during a liquidity crisis. It is the combination of higher borrowing costs with the fact that GDP growth cannot be stimulated through depreciation of the domestic currency that raises the risk of transforming a liquidity crisis into a solvency crisis.

In any case, we view the results in Tables 5–7 as only tentative. We also note that the reported models in Tables A.4–A.6 (which use economic policy uncertainty rather unconventional monetary policy and tackle endogeneity by using instruments) deliver a better fit in terms of a lower Akaike Information Criterion (AIC) than the models with unconventional monetary policy in Tables 5–7 in 9 out of the 15 quantiles of the rating distribution for Moody's and S&P's and in 8 out of the 15 quantiles of the rating distribution for Fitch.[20] In any case, we acknowledge that further research is necessary in order to assess more in detail the relationship between unconventional monetary policy and credit rating decisions.

4.3. A series of robustness checks

4.3.1. Model estimates using alternative uncertainty indices

As alternatives to the European policy uncertainty index, we use (a) the US policy uncertainty index of Baker et al. (2016) and (b) the Euro area uncertainty proxy of Girardi and Reuter (2017). Like the European policy uncertainty index, the US one captures the policy related economic uncertainty by counting the number of newspaper articles containing the terms uncertain or uncertainty, economic or economy, and one or more policy-relevant terms of ten leading newspapers (including *The Washington Post*, *The New York Times* and *The Wall Street Journal*) and can be thought of as capturing spillover US economic policy effects to the Eurozone area. On the other hand, the Girardi and Reuter (2017) uncertainty measure pools information

[19] The survey is run by the Centre for Macroeconomics, an ESRC centre established by LSE, UCL, Cambridge, the Bank of England, the National Institute of Economics and Social Research (NIESR) and now Oxford; see: http://cfmsurvey.org/surveys/german-council-economic-experts-view-ecb-policy.

[20] The models in Tables 2–4 (which rely on economic policy uncertainty but do not tackle endogeneity issues) also deliver a better fit in terms of a lower AIC than the models with unconventional monetary policy in Tables 5–7 in 12 out of the 15 quantiles of the rating distribution for Moody's, in 7 out of the 15 quantiles of the rating distribution for S&P's and in 8 out of the 15 quantiles of the rating distribution for Fitch.

from 22 forward-looking business and consumer survey questions contained in the EU Business and Consumer Surveys programme (see Girardi and Reuter, 2017).

The correlation between the European and US policy indices is equal to 0.80 whereas the correlation between the European policy index and the survey-based uncertainty measure of Girardi and Reuter (2017) is much weaker and equal to 0.20. Fig. 4 plots the three uncertainty measures together with the VSTOXX volatility index which is a measure of financial uncertainty (we discuss this in detail below). Notice that European policy uncertainty is much more volatile than the remaining uncertainty measures (see also the summary statistics in Table A.2); it also shows a marked increase following from the 2008–2009 financial crisis and the most recent Eurozone debt crisis in 2011–2012. It drops after ECB President Mario Draghi pledged in 2012 that the ECB was 'ready to do whatever it takes' to protect the Eurozone from collapse.[21]

Appendix Tables A.7–A.9 report the empirical estimates using the US economic policy uncertainty index. As can be seen from Tables A.7–A.9, there is a spillover negative impact of US uncertainty on Eurozone's credit ratings but the impact is smaller compared to the European uncertainty impact reported in Tables 2–4. There is mixed evidence in terms of whether the model using the European policy uncertainty index dominates the model using the US one. In the case of Moody's, the model using the European uncertainty index delivers a lower Akaike Information Criterion (AIC) than the model using the US index in 7 out of the 15 quantiles of the rating distribution. In the case of S&P's, the model using the European uncertainty index delivers a lower AIC than the model using the US index in 6 out of the 15 quantiles of the rating distribution. In the case of Fitch, however, the dominance of the European index is much stronger; indeed, the model using the European uncertainty index delivers a lower AIC than the model using the US index in 11 out of the 15 quantiles of the rating distribution. To save space, we do not report our estimates using the uncertainty survey-based measure of Girardi and Reuter (2017); these estimates are available on request. We note, however, that the statistical evidence in favour of a negative impact of the uncertainty survey-based measure is much weaker (for Moody's, this happens in 6 out of the 15 quantiles of the rating distribution; the corresponding figures for S&P's and Fitch are 7 and 8, respectively).

Compared to the alternative uncertainty measures, the stronger impact of the European policy uncertainty index should not necessarily come as a surprise. Policymakers have arguably been rather slow in putting together a workable plan dealing with the Eurozone crisis as planning requires in general parliamentary approval from all member states. In addition, the major institutions (nick-named as the 'Troika' of the International Monetary Fund, the European Commission and the European Central Bank) have not always agreed on how to deal with issues of the crisis therefore fuelling policy uncertainty in the Euro area.[22] Indeed, Eurozone's institutional infrastructure was not prepared to deal with the crisis. Baldwin and Giavazzi (2015, p. 21) noted in a critical manner that "judging from market reactions, each policy intervention made things worse" and that it was only in the summer of 2012 with the 'whatever it takes' assertion by ECB President Mario Draghi that the corner was turned.

As a further robustness check, we consider alternative financial measures of uncertainty. In particular, we consider the VSTOXX volatility index (see Fig. 4; this is based on EURO STOXX 50 real-time options prices and is designed to reflect the market expectations of near-term up to long-term volatility by measuring the square root of the implied variance across all options of a given time to expiration) as well as individual country-level measures, namely stock price volatility.[23] Appendix Tables A.10–A.12 report estimates using the VSTOXX index (results are qualitatively similar when we treat all explanatory variables as endogenous and use their first-order lags as instruments; these are available on request). The VSTOXX index, which has a mild positive correlation with the economic policy uncertainty measure (the correlation is equal to 0.27), exerts a negative effect on most credit rating quantiles in the case of Fitch and S&P's whereas such evidence is less robust in the case of Moody's.

To save space, we do not report estimates using the country-specific stock price volatility indices (these are available on request). We note, however, that country-specific volatility indices also exert a predominantly negative effect on credit ratings; we also note that in the case of Moody's, the impact is statistically insignificant in 6 (out of the 15) quantiles. For S&P's and Fitch, the impact is statistically insignificant in 4 and 2 quantiles, respectively.

4.3.2. Other robustness checks

We proceed with further robustness checks. Reusens and Croux (2017) and Afonso et al. (2007, 2011) underline that mapping ratings into a linear scale implies that the absolute distances in the underlying degree of creditworthiness between subsequent credit rating categories are equally spaced. This assumption may lead to a significant bias, especially in the presence of numerous elements in the end categories. Given that 25% of observations are in the highest rating category, the bias might not be negligible. With this in mind, we proceed with another robustness check. In particular, we follow Afonso et al. (2007) in considering a logistic transformation of credit ratings (for more details see Appendix 3 in Afonso et al., 2007).

Briefly, the logistic transformation is given by $L_i = \ln[R_i/(1 - R_i)]$, where $R_i = (2i - 1)/(2n_c)$, the number of categories, n_c , equals 21 and (from the last column of Table 1) the rating grades are $i = 1,2, \ldots,21$. Fig. A4 plots together the linear and logistic transformation for Moody's sovereign credit ratings. In the logistic transformation, the differences between categories are not constant, but are still imposed *a priori*. Tables A.13–A.15 report our empirical results.

In line with our main results in Tables 2–4, CRAs attribute a higher weight on GDP per capita for high rated countries and the impact of government debt is higher at the low as opposed to the middle of the rating distribution; at the same time, the

[21] See e.g. http://www.telegraph.co.uk/finance/financialcrisis/9428894/Debt-crisis-Mario-Draghi-pledges-to-do-whatever-it-takes-to-save-euro.html.

[22] See e.g. http://www.bbc.co.uk/news/business-33531845.

[23] Volatility of stock price index is the 360-day standard deviation of the return on the national stock market index. (Bloomberg). This is available from the Federal Reserve Bank of St Louis database.

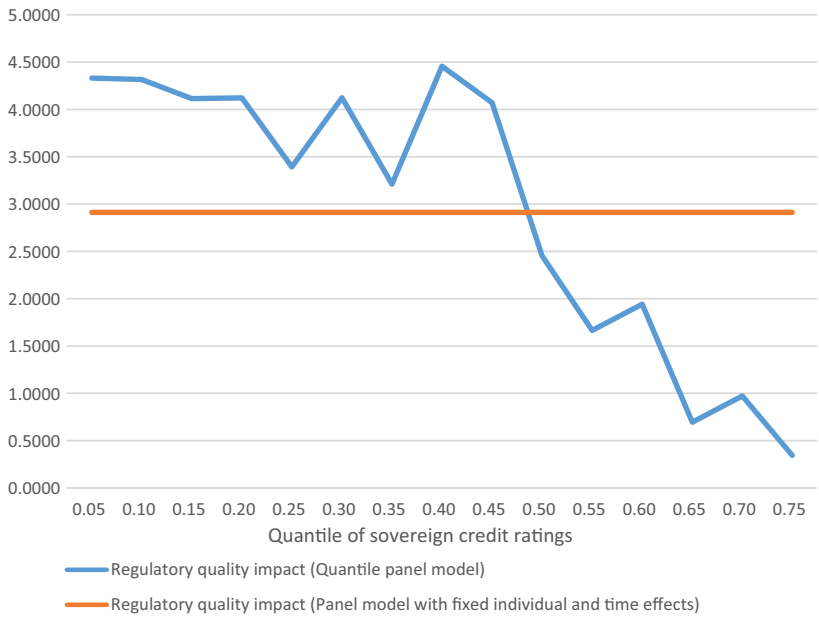

Fig. 5. Impact of regulatory quality on ratings for Moody's: Quantile panel model versus standard panel model with fixed individual and time effects.

impact of the unemployment rate remains stronger at the low-to-middle end of the rating distribution. In contrast to our main results in Tables 2–4, however, the impact of regulatory quality turns out not to be stronger for lower rated countries and the impact of the current account remains predominantly positive throughout the distribution for the three CRAs.

As a further robustness check, we explore whether our main results in Tables 2–4 also hold by aggregating contiguous quantiles. Tables A.16–A18 report estimates of the model for the 0.25, 0.50, and 0.75 quantiles for each of the three CRAs. In line with our main results in Tables 2–4, the impact of competitiveness is stronger at the low quantile of the distribution and the impact of GDP per capita is stronger at the high quantile of the distribution. In line with our results in Tables 2–4, the impact of unemployment and regulatory quality is stronger at lower ratings for S&P's and Fitch but not for Moody's. As in Tables 2–4, the impact of the current account is positive at the lower quantiles of the distribution for S&P's but not for the other CRAs and the impact of government debt is lower at the middle of the rating distribution for all CRAs.

Reusens and Croux (2017) document that the credit rating agencies changed their sovereign credit rating assessment after the start of the European debt crisis in 2009 which suggests time-varying credit rating decisions made by the CRAs (see also Boumparis et al., 2015). If the impact of an explanatory variable varies over time, the greater impact on lower quantiles may depend on a different sample composition in crisis and non-crisis periods; in fact, there may be more countries in lower quantiles during crisis periods. To deal with this issue, we attempted to re-estimate our panel quantile model in two separate periods: 2002–2008 and 2009–2015, respectively. Bearing in mind the very small sample in these separate periods, a rather large number of our coefficient estimates turned out to be statistically insignificant throughout the credit rating distribution. In any case, the quantile model, estimated over the whole sample period, provides a reasonable representation of the economic impact of our qualitative and quantitative factors on credit ratings since it is more robust than standard linear models to outliers and combines information before and during the crisis. That said, and given the interest of our paper in the European economic policy uncertainty variable, we pursue the issue of time-varying effects further by estimating a time-varying model which allows for the impact of all explanatory variables to change during periods of high policy uncertainty (when policy uncertainty exceeds its sample mean) as opposed to periods of low uncertainty (when policy uncertainty falls below its sample mean). In particular, we model credit ratings Y_{it} as follows:

$$\begin{aligned} Y_{it} = {} & \beta_0 + (\beta_{GDP}^{Low} GDP\_per\_Capita_t + \beta_{Debt}^{Low} Debt_t + \beta_{ca}^{Low} current\_account_t + \\ & + \beta_{inf}^{Low} inflation_t + \beta_u^{Low} unemployment_t + \beta_{Reg}^{Low} Reg\_quality_t + \\ & + \beta_{comp}^{Low} competitiveness_t + \beta_{unc}^{Low} uncertainty_t + \beta_{fiscal}^{Low} fiscal_t)(1 - I_t^{unc}) + \\ & + (\beta_{GDP}^{High} GDP\_per\_Capita_t + \beta_{Debt}^{High} Debt_t + \\ & + \beta_{ca}^{High} current\_account_t + \beta_{inf}^{High} inflation_t + \\ & + \beta_u^{High} unemployment_t + \beta_{Reg}^{High} Reg\_quality_t + \\ & + \beta_{comp}^{High} competitiveness_t + \beta_{unc}^{High} uncertainty_t + \beta_{fiscal}^{High} fiscal_t) I_t^{unc} + u_{it}, \end{aligned} \tag{7}$$

where the indicator function

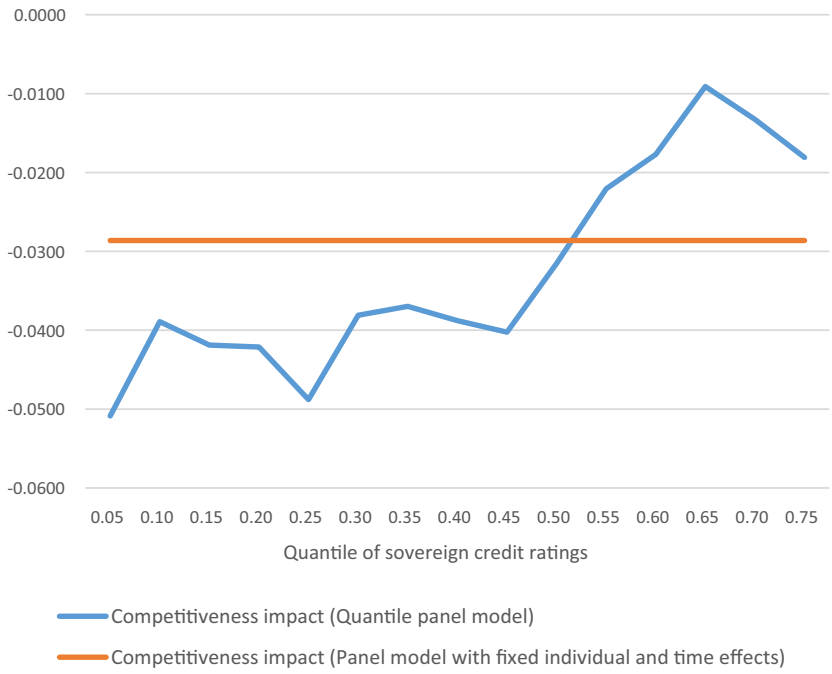

Fig. 6. Impact of competitiveness on ratings for Fitch: Quantile panel model versus standard panel model with fixed individual and time effects.

$$I_t^{unc} = \left\{ \begin{array}{ll} 1, & if\ uncertainty_t > \overline{uncertainty} \\ 0, & otherwise \end{array} \right\}, \tag{8}$$

allowing also for fixed individual and time effects. In model (7) and (8), the impact of (say) GDP per capita switches from β_{GDP}^{Low} (when uncertainty is below its mean, that is, $I_t^{unc} = 0$) to β_{GDP}^{High} (when uncertainty is above its mean, that is, $I_t^{unc} = 1$; similar arguments hold for the remaining variables). Notice that model (7) and (8) also allows for the differential impact from the fiscal balance-to-GDP ratio which turned out to be statistically insignificant in Section 4.2 of the paper. Doing so allows us to assess whether the impact of fiscal balance changes as we move from periods of low uncertainty to periods of high uncertainty.

Estimates of model (7) and (8) reported in Table A.19 suggest that GDP per capita, government debt, uncertainty and indeed the fiscal-balance-to-GDP ratio have a stronger economic impact on credit rating decisions for all CRAs when uncertainty is high (from Fig. 4, our European economic policy uncertainty exceeds its mean (reported in Table A.2) of 137.553 from 2010 onwards) whereas current account, competitiveness, the unemployment rate and inflation have a stronger economic impact on credit rating decisions when uncertainty is low (in our sample this happens over the 2002–2009 period). The *F*-tests also reported in Table A.19 test for equal effects from each control variable across regimes (low versus high uncertainty). In general, the *F*-tests confirm equality for the majority of coefficients across regimes**.** That said, some statistical evidence in favour of differential impact from some of the control variables across regimes remains. This is most evident (in terms of very low *p*-values) for government debt in the case of Moody's and S&P's. We also note that, for all CRAs, the impact of the fiscal balance switches from negative (and statistically insignificant) during periods of low uncertainty to positive (and statistically significant) during periods of high uncertainty. Hence, our results for the fiscal balance-to-GDP ratio are in line with those of Reusens and Croux (2017) who identified a significant positive effect from the fiscal balance-to-GDP ratio on credit ratings only after 2009.

Finally, our quantile panel model offers valuable and additional information compared to a standard panel model with fixed individual and time effects; detailed estimates of the latter model for all three CRAs are available on request. We illustrate some differences between the two models by focusing on the impact of regulatory quality in Fig. 5 and on the impact of competitiveness in Fig. 6. Fig. 5 plots the estimated impact of regulatory quality for Moody's across the conditional distribution of credit ratings (based on the quantile panel model reported in Table 2) together with the estimated impact of regulatory quality for a standard panel model with fixed individual and time effects (which is equal to 2.912); the latter focuses on the conditional mean response of credit ratings. Fig. 6 plots the estimated impact of competitiveness for Fitch across the conditional distribution of credit ratings (based on the quantile panel model reported in Table 4) together with the estimated impact of competitiveness for the standard panel model with fixed individual and time effects (which is equal to −0.0286).

Table 8
Impact of European policy uncertainty on ratings for Moody's.

Year	Greece	Ireland	Italy	Portugal	Spain	Cyprus
2008	−0.677	−0.268	−0.559	−0.559	−0.268	−0.495
2009	−0.444	−0.158	−0.400	−0.354	−0.191	−0.354
2010	−1.154	−0.868	−1.154	−2.243	−0.456	−1.022
2011	−3.266	−3.266	−1.762	−3.266	−3.088	−1.588
2012	−3.761	−3.761	−1.376	−3.761	−1.829	−3.761
2013	−2.948	−1.433	−1.079	−2.948	−1.433	−2.948
2014	−1.694	−0.620	−0.620	−0.824	−0.620	−1.694
2015	−2.251	−0.811	−0.824	−1.094	−0.824	−2.251

Notes: Table 8 illustrates the effects of European policy uncertainty on credit ratings by using estimates of our credit rating model under uncertainty to infer what credit ratings would have been had uncertainty remained at its 1999–2001 average value. To do this, we construct the difference between the fitted values of the estimates of credit rating model (1) for Moody's (as reported in Table 2) and the fitted values of the counterfactual model (1) which sets the post 2007 values of the uncertainty variable equal to its 1999–2001 average.

Table 9
Impact of European policy uncertainty on ratings for S&P's.

Year	Greece	Ireland	Italy	Portugal	Spain	Cyprus
2008	−0.535	−0.228	−0.235	−0.541	−0.300	−0.235
2009	−0.298	0.018	−0.168	−0.328	−0.276	−0.168
2010	−1.603	−1.162	−0.484	−1.502	0.052	−1.162
2011	−2.206	−1.184	−1.600	−1.130	−1.538	−1.130
2012	−2.540	−1.363	−1.302	−2.540	−1.302	−2.540
2013	−1.991	−1.069	−1.020	−1.991	−1.020	−1.991
2014	−1.144	−0.788	−0.586	−1.144	−0.586	−1.144
2015	−1.520	−0.459	−0.779	−0.779	−1.424	−1.520

Notes: Table 9 illustrates the effects of European policy uncertainty on credit ratings by using estimates of our credit rating model under uncertainty to infer what credit ratings would have been had uncertainty remained at its 1999–2001 average value. To do this, we construct the difference between the fitted values of the estimates of credit rating model (1) for S&P's (as reported in Table 3) and the fitted values of the counterfactual model (1) which sets the post 2007 values of the uncertainty variable equal to its 1999–2001 average.

Table 10
Impact of European policy uncertainty on ratings for Fitch.

Year	Greece	Ireland	Italy	Portugal	Spain	Cyprus
2008	0.143	0.087	0.175	−0.036	0.087	−0.348
2009	−0.134	0.125	0.125	0.125	0.062	−0.249
2010	−0.837	−0.386	0.361	−0.861	0.066	−0.717
2011	−3.187	−0.531	−1.185	−3.187	−0.987	−1.152
2012	−3.670	−0.611	−1.236	−3.670	−1.327	−3.670
2013	−2.876	−0.479	−0.479	−2.876	−1.040	−2.876
2014	−1.653	−0.557	−0.275	−1.653	−0.557	−1.653
2015	−2.196	−0.644	−0.740	−0.794	−0.740	−2.196

Notes: Table 10 illustrates the effects of European policy uncertainty on credit ratings by using estimates of our credit rating model under uncertainty to infer what credit ratings would have been had uncertainty remained at its 1999–2001 average value. To do this, we construct the difference between the fitted values of the estimates of credit rating model (1) for Fitch (as reported in Table 4) and the fitted values of the counterfactual model (1) which sets the post 2007 values of the uncertainty variable equal to its 1999–2001 average.

As can be seen from Figs. 5 and 6, relying on the impact of the model with fixed effects misses valuable information across the quantile distribution that can only be captured by the quantile panel model discussed throughout this paper.[24]

5. Discussion of results and policy implications

From a policy point of view, and noting the higher relative importance of the competitiveness and regulatory quality indices for Eurozone countries with low credit ratings, our results suggest that structural reforms and improvements in

[24] From Figs. 1 and 2, there is relatively low time variation in regulatory quality and competitiveness which suggests that the impact effects of our quantile model reported in Figs. 5 and 6 mainly explore the cross-country dimension.

the competitiveness profile of these very countries will improve significantly their low rating profile and therefore reduce their borrowing costs in financial markets. This is in line with policy recommendations recently put forward by the European Commission.[25] In addition, a decrease in policy uncertainty in the Eurozone area could definitely favour all countries, but low rated would gain more in terms of their credit rating score. We also note the potential of indirect spillover effects from sovereign credit rating decisions on low rated countries to Eurozone's sovereign bond yields; for instance, De Santis (2014) identifies spillover effects in terms of the direct impact of a Greek credit rating downgrade on other Eurozone sovereign yields.

We can illustrate the effects of European uncertainty on credit ratings by using estimates of our credit rating model under uncertainty to infer what credit ratings would have been had uncertainty remained at its pre-financial and pre-European debt crisis average value. Notice that we choose as representative of the pre-financial and pre-European crisis the average value over 1999–2001 rather than the average value over 2002–2007 because, following from our discussion at the end of Section 2 (and in Section 4.2), the latter period could be interpreted as the pre-crisis unsustainable exuberance. Contrast this with the 1999–2001 period which covers the first three years of the life of the Euro. Over this arguably more 'cautious' period, the ECB discount rate recorded an average of 4.73% and the EONIA rate (the one-day interbank interest rate for the Eurozone) recorded an average of 3.75%; on the other hand, over the 2002–2007 period the ECB discount rate recorded a lower average of 3.71% and the EONIA rate recorded a lower average of 2.74%.[26]

We illustrate the effects of European uncertainty on credit ratings by constructing the difference between the fitted values of the estimates of credit rating model (1) for each CRA (as reported in Tables 2–4) and the fitted values of the counterfactual model (1) which sets the post 2007 values of the uncertainty variable equal to its 1999–2001 average. Tables 8–10 report the difference between the fitted and the counterfactual values for Eurozone's periphery, namely all GIIPS (that is, Greece, Ireland, Italy, Portugal and Spain) and Cyprus where a negative value of this difference indicates that credit ratings are lower because of the increased uncertainty.

Our estimates suggest that economic policy uncertainty has impacted negatively on the credit ratings of all GIIPS and Cyprus during the 2008–2015 period. The impact has been more prolonged for Greece. Notice that uncertainty has reduced Greece's credit rating by some 3 to 4 notches at the height of the Eurozone crisis in 2011 and 2012 (the impact is higher in the case of Moody's and Fitch and slightly lower in the case of S&P's). This is not surprising. Greece has witnessed successive bail-outs and still remains (at the time of writing this paper) on bail-out support.[27]

From Tables 8–10, the impact of uncertainty on the remaining GIIPS and Cyprus is still substantial but, in general, less severe than what Greece witnessed (Portugal suffered, due to uncertainty, the same rating downgrades as Greece in 2011–2014; Cyprus suffered, due to uncertainty, the same rating downgrades as Greece in 2012–2015).[28] Again, this should not come as a surprise as the remaining GIIPS and Cyprus witnessed less 'expensive' and 'smoother' bail-outs; in fact, all these countries are now off bail-out support.[29]

Earlier work by Livingston et al. (2010) suggests that Moody's is more conservative (in the sense that it gives more inferior ratings) than S&P's using data on US corporate bond rating decisions. From Tables 8–10, the impact of uncertainty on the GIIPS and Cyprus is in general more severe for Moody's than for S&P's and for Fitch. Hence, our findings support the work of Livingston et al. (2010) in the sense that, since the recent financial and Eurozone crises, Moody's have remained more conservative than the other CRAs because of European policy uncertainty concerns.

Returning to Greece, we note that the Boards of Directors of the European Stability Mechanism (ESM) and European Financial Stability Facility (EFSF) [30] adopted, in January 2017, a set of short-term debt relief measures for Greece aiming at a cumulative reduction of Greece's debt-to-GDP ratio of around 20 percentage points until 2060.[31]

Policymakers from the so-called 'Troika' have repeatedly pointed out that Greece needs to proceed with structural reforms and improve its competitiveness as prerequisites for getting substantial 'medium term relief'. At the time of writing, Greece stood at the 0.05 quantile of the rating distribution of S&P's (and the remaining CRAs), some 5 notches deep into 'junk status territory' [32] faced with a 7% servicing cost for its 10-year debt; this was some 3 percentage points higher than the 10-year

[25] See: http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_comm_en.pdf.

[26] See https://fred.stlouisfed.org/series/INTDSREZQ193N and http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=198.EON.D.EONIA_TO.RATE.

[27] Greece, which was bailed-out twice (for €110bn in 2010 and then again for €109bn in 2011), negotiated, in February 2012, a new €130bn rescue package involving a voluntary haircut of some 53.5% on the face value of its bonds held by the private sector. Eurozone ministers agreed (in November 2012) to cut Greece's debt by a further €40bn. In July 2015, Greece was bailed-out for a third time for €86bn.

[28] Notice, in Tables 8–10, some overlapping for a number of countries in a number of years. This should not come as a surprise. For a given quantile, the difference between the fitted values of the estimates of our credit rating model and the fitted values of the counterfactual model is equal to the estimated coefficient on uncertainty (for the quantile in question) times the difference between uncertainty in time period t and mean uncertainty (over 1999–2001). Recall that European uncertainty does not vary at the cross-sectional dimension. When two (or more) countries are placed in the same quantile of the rating distribution for a given time period t, the difference between the fitted values of the estimates of our credit rating model and the fitted values of the counterfactual model is the same.

[29] Ireland was bailed-out for €85bn in November 2010. Portugal was bailed-out for €78bn in May 2011. Spain was granted, in July 2012, financial assistance from the European Stability Mechanism (ESM) for up to €100bn. Cyprus was bailed-out for €10bn in March 2013. See, for instance, the discussion in Dergiades et al., 2015 and *The Financial Times* 'dedicated' website (at https://www.ft.com/topics/themes/Greece_Debt_Crisis).

[30] ESM is a European Union permanent agency that provides financial assistance, in the form of loans, to Eurozone countries or as new capital to banks in difficulty. It has replaced the temporary EFSF.

[31] See: https://www.esm.europa.eu/press-releases/esm-and-efsf-approve-short-term-debt-relief-measures-greece.

[32] In 2017, the S&P's, Moody's and Fitch credit rating scores for Greece were B-, Caa3, and CCC, respectively. From Table 1, junk (or high credit risk) sovereign bonds carry a credit rating of BB+ or lower for S&P's and Fitch and a credit rating of Ba1 or lower for Moody's.

Portuguese yield and 5 percentage points higher than the 10-year Spanish yield. Future rating upgrades of Greece (triggered, for instance, by accelerating structure reforms) will definitely push down Greek borrowing costs.[33]

Although a deep front 'voluntary' haircut on Greek debt is not on the 'negotiating table', our estimates (in Table 3 for S&P's) suggest that a haircut of as many as 36 percentage points in the debt-to-GDP ratio (that is, from 179.7% in 2016 to 143.7% in 2017) will, *ceteris paribus*, raise Greece's credit rating by only 1 notch (≈36∗0.0277; results are similar using the estimates in Table 2 for Moody's and in Table 4 for Fitch, respectively). A speedier and much more realistic (since debt haircut is not on the 'negotiating table') Greek exit from the 'junk status territory' would indeed be triggered by structural reforms (and an improvement in competitiveness). For instance, our estimates (in Table 3 for S&P's) suggest that Greece would witness an upgrade of almost 3 notches[34] by S&P's, if it were to implement structural reforms that would raise its regulatory quality index to the level observed for Portugal.

6. Conclusions

This paper examines the determinants of sovereign credit ratings for the Eurozone countries from 2002 to 2015 in a panel quantile framework which allows the relative significance of the explanatory variables to vary across the quantile distribution of sovereign ratings. Our results are summarised as follows: First, the impact of the unemployment rate, regulatory quality and competitiveness is stronger for low rated countries whereas GDP per capita is a major driver of high rated countries; in other words, the high level of GDP per capita provides a 'safety net' safeguarding (to some extent) against downgrades in the case of high rated countries. Second, a reduction in the current account deficit or an increase in the current account surplus leads to a rating or outlook upgrade for low rated countries which have historically recorded high current account deficits whereas, for countries with strong payment capacity, a higher current account deficit or a lower current account surplus is associated with either higher creditworthiness or positive economic prospects of the economy and consequently a higher sovereign rating. Third, economic policy uncertainty impacts negatively on credit ratings across the quantile distribution; however, the impact is stronger on the lower rated countries. In other words, the creditworthiness of low rated countries takes a much bigger 'hit' than that of high rated countries when European uncertainty is on the rise.

Our model, which allows for differential impact across the rating distribution, could arguably go some way towards shedding some light on how CRAs assign sovereign credit ratings. For instance, our counterfactual analysis suggests the pivotal role that economic policy uncertainty in the Euro area has played in driving down sovereign credit ratings in Eurozone's periphery. We believe that our empirical analysis and results provide valuable information which can potentially be used by a new credit rating agency towards making credit rating decisions if indeed European policymakers decide to set up such an agency in the near future.

Acknowledgements

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Appendix A.

See Figs. A1–A4 and Tables A.1–A.19

[33] Gibson et al. (2017) discuss in detail the strong interaction between sovereign ratings, sovereign borrowing costs and bank ratings in the Eurozone area.

[34] We derive 3 notches as ≈[(0.940–0.397)*5.075]; 5.075 is the estimated coefficient on regulatory quality and 0.947 and 0.397 refer to the regulatory quality values for Portugal and Greece, respectively.

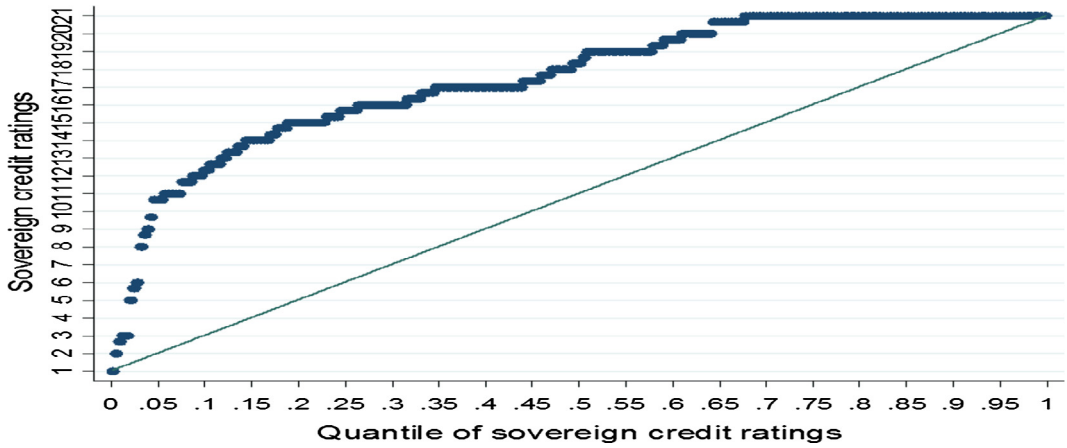

Fig. A1. Mapping of sovereign credit ratings to quantile distribution for Moody's.

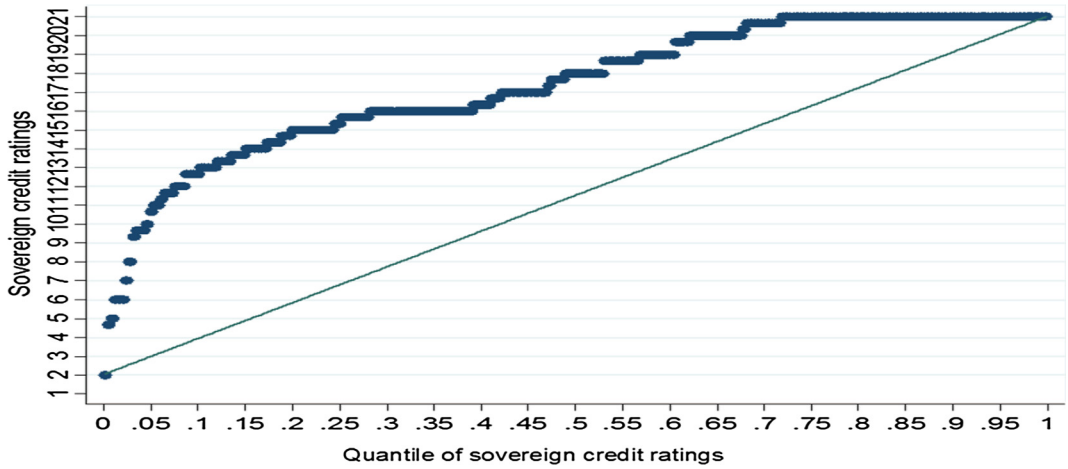

Fig. A2. Mapping of sovereign credit ratings to quantile distribution for S&P's.

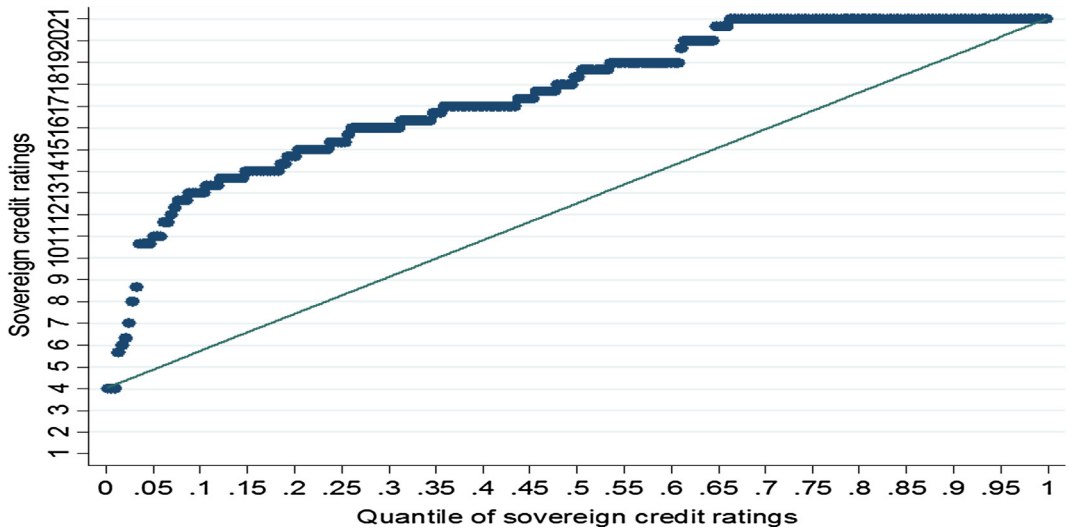

Fig. A3. Mapping of sovereign credit ratings to quantile distribution for Fitch.

Fig. A4. Linear and logistic transformation of sovereign credit ratings for Moody's.

Table A.1
Data definitions and sources.

Data Definitions		
Variable Name	Definition	Source
Fitch rating	Sovereign rating attributed at 31st December of each year	Fitch
S&P's rating	Sovereign rating attributed at 31st December of each year	S&P's
Moody's rating	Sovereign rating attributed at 31st December of each year	Moody's
GDP per capita	Log GDP per capita, US dollars, constant 2005 prices	World Bank
Government debt	General government gross dedt as a percent of GDP	IMF WEO
Current account balance	Current account balance as a percent of GDP	IMF WEO
Unemployment Rate	Unemployment rate as a percent of total labour force	IMF WEO
Inflation Rate	Annual growth rate of consumer price index	IMF WEO
Regulatory Quality	Aggregate government indicator	World Bank
Competitiveness Indicator	Harmonised competitiveness indicator based on unit labour costs indices for the total economy	ECB
European Policy Uncertainty	Eurozone's countries average	www.policyuncertainty.com
US Policy Uncertainty	United State's Policy Uncertainty	www.policyuncertainty.com
Survey based Uncertainty	Uncertainty measure which pools information from 22 forward-looking Business and consumer survey questions contained in the EU Business and Consumer Surveys programme	Girardi and Reuter (2017)
ECB Securities	ECB purchases and holdings of securities as a percent of Eurozone GDP	ECB Database
ECB Balance Sheet	Annual consolidated balance sheet of the Eurosystem as a percent of Eurozone GDP	ECB Database
VSTOXX Index	Market expectations of near-term up to long-term volatility	www.stoxx.com
Stock Market Volatilility	Country specific stock market volatility	Fred

Table A.2
Summary statistics of the data variables.

Variable	Min.	1st Quartile	Median	Mean	3rd Quartile	Max.	St. Dev.
Moody's ratings	1	15.670	18.330	17.461	21	21	3.997
S&P's ratings	2	15.415	18.000	17.343	21	21	3.711
Fitch ratings	4	15.330	18.330	17.549	21	21	3.669
Log GDP per capita	3.904	4.294	4.491	4.474	4.652	5.041	0.244
Government debt	3.664	35.783	61.717	61.771	85.067	178.396	36.227
Current account balance	−20.918	−5.007	−0.623	−1.168	2.563	11.923	6.108
Inflation Rate	−1.706	1.124	2.175	2.282	3.174	15.252	2.036
Unemployment Rate	2.500	5.982	8.246	9.171	11.038	27.251	4.617
Regulatory Quality	0.345	0.987	1.236	1.262	1.557	1.921	0.352
Competitiveness Indicator	81.733	98.940	105.490	109.852	114.678	180.527	18.095
European Policy Uncertainty	76.955	101.337	131.890	137.553	167.255	209.986	42.489
US Policy Uncertainty	67.136	87.878	126.870	116.888	141.448	157.977	31.426
Survey Based Uncertainty	88.290	92.422	96.426	97.826	101.031	113.648	7.724
ECB Securities	0	0	0.155	1.396	2.374	7.684	2.072
ECB Balance Sheet	0.104	0.123	0.207	0.190	0.229	0.301	2.036
VSTOXX Index	14.045	18.567	24.332	24.858	32.111	37.285	7.207
Stock Market Volatilility	8.170	14.337	19.208	21.477	26.975	61.334	9.764

Table A.3
Information on the credit rating distribution, 2002–2015.

Moody's			S&P's			Fitch		
Quantile	Country	Year	Quantile	Country	Year	Quantile	Country	Year
0.05	Greece	2011–2015	0.05	Greece	2010–2015	0.05	Greece	2011–2015
	Ireland	2011–2012		Portugal	2012–2014		Cyprus	2012–2015
	Portugal	2011–2013		Cyprus	2012–2015		Portugal	2011–2014
	Cyprus	2012–2015		Latvia	2009		Latvia	2009
	Slovenia	2013	0.10	Italy	2012–2015	0.10	Greece	2010
0.10	Greece	2010		Spain	2012–2014		Latvia	2008, 2010, 2011
	Ireland	2013		Portugal	2011, 2015		Portugal	2015
	Portugal	2014–2015		Cyprus	2011		Slovakia	2002
	Spain	2012–2013		Latvia	2008, 2010, 2011		Spain	2012–2013
	Cyprus	2011		Lithuania	2009		Lithuania	2002, 2009–2012
	Latvia	2009–2012	0.15	Greece	2009		Cyprus	2011
	Slovenia	2012, 2014, 2015		Ireland	2011–2013	0.15	Greece	2009
0.15	Italy	2012–2015		Latvia	2007, 2012		Ireland	2010–2013
	Ireland	2010, 2014		Slovakia	2002, 2003		Italy	2013–2014
	Spain	2014, 2015		Lithuania	2002, 2008, 2010–2013		Estonia	2009
	Latvia	2013, 2014	0.20	Spain	2015		Latvia	2002, 2012
	Lithuania	2009–2012		Portugal	2010		Slovakia	2003
0.20	Ireland	2015		Estonia	2002, 2009		Slovenia	2013
	Latvia	2008, 2015		Latvia	2002–2005, 2013		Lithuania	2008, 2013
	Malta	2002–2005, 2012–2015		Malta	2012–2015	0.20	Ireland	2014
	Lithuania	2002, 2013–2014		Lithuania	2015		Italy	2012, 2015
0.25	Greece	2009	0.25	Ireland	2010		Spain	2014–2015
	Italy	2011		Italy	2011		Estonia	2002, 2008
	Cyprus	2002		Cyprus	2010		Latvia	2003, 2007, 2013
	Malta	2006, 2011		Estonia	2003		Slovenia	2012, 2014, 2015
	Slovakia	2002–2004, 2012		Latvia	2006, 2014, 2015		Lithuania	2013
	Lithuania	2003–2005, 2008, 2015		Slovenia	2013–2015	0.25	Ireland	2007
0.30	Cyprus	2003–2006		Lithuania	2004, 2014, 2015		Estonia	2003
	Latvia	2002–2005, 2007		Slovakia	2004		Latvia	2004–2006, 2014–2015
	Slovakia	2013–2015	0.30	Greece	2004–2008		Slovakia	2004
	Lithuania	2006, 2007		Estonia	2007–2008		Lithuania	2004–2007, 2014–2015

(*continued on next page*)

Table A.3 (*continued*)

Moody's			S&P's			Fitch		
Quantile	Country	Year	Quantile	Country	Year	Quantile	Country	Year
0.35	Greece	2002–2006		Malta	2002–2011	0.30	Greece	2004–2008
	Portugal	2010		Slovenia	2012		Estonia	2006–2007, 2010
	Spain	2011		Lithuania	2007		Malta	2002,2013–2015
	Estonia	2007–2009	0.35	Greece	2004–2008		Slovakia	2005–2006
	Latvia	2006		Ireland	2014	0.35	Greece	2002–2003
	Malta	2007		Cyprus	2002–2006		Italy	2011
	Slovakia	2005		Estonia	2004, 2006, 2010		Cyprus	2002
	Slovenia	2011	0.40	Greece	2002		Portugal	2010
0.40	Estonia	2002–2005, 2010–2015		Portugal	2009		Estonia	2004, 2005
	Malta	2008–2010		Cyprus	2007		Malta	2003–2006
	Slovakia	2007		Slovakia	2005–2007, 2011–2014		Slovakia	2007–2008
0.45	Belgium	2011–2015		Estonia	2005		Slovenia	2002
	Greece	2007–2008		Slovenia	2002	0.40	Estonia	2011–2015
	Cyprus	2007		Lithuania	2005–2006		Malta	2007–2012
	Estonia	2006	0.45	Greece	2003		Slovakia	2009–2011
	Slovakia	2006,2008–2011		Ireland	2015	0.45	Slovakia	2012–2015
0.50	Italy	2002–2006		Italy	2006–2010		Cyprus	2003–2010
	France	2015		Cyprus	2008–2009		Spain	2011
	Portugal	2009		Slovakia	2008–2010, 2015		Slovenia	2003
	Cyprus	2008–2010		Slovenia	2003	0.50	Belgium	2012, 2014, 2015
	Slovenia	2002–2005	0.50	Italy	2004–2005		Italy	2005–2010
0.55	Italy	2007–2010		Portugal	2005–2008		Ireland	2009
	Portugal	2002–2008		Spain	2011		Portugal	2009
	Slovenia	2008–2010		Estonia	2011–2015		Slovenia	2004, 2005, 2011
0.60	Belgium	2004–2010		Slovenia	2004, 2011	0.55	Belgium	2002–2005,2013
	France	2012–2014	0.55	Belgium	2011–2015		France	2014, 2015
	Ireland	2009		France	2013–2015		Italy	2002–2004
	Spain	2010		Ireland	2009		Portugal	2002–2006
	Slovenia	2006–2007		Italy	2003	0.60	Austria	2015
0.65	Belgium	2002–2003		Portugal	2004		Belgium	2006–2011
	Austria	2012, 2013, 2015		Spain	2010		Portugal	2007–2008
	Finland	2015		Slovenia	2005, 2010		Slovenia	2006–2010
	Germany	2012, 2013	0.60	Austria	2012–2015	0.65	France	2011–2013
	Luxemburg	2012, 2013		Belgium	2010		Finland	2015
	Netherlands	2012, 2013		France	2012		Netherlands	2013
0.70–0.75	Austria	2002–2011, 2014		Italy	2002		Spain	2002–2010
	Finland	2002–2014		Portugal	2002–2003		France	2002–2007
	France	2002–2011		Spain	2009	0.70–0.75	Austria	2002–2014
	Germany	2002–2011, 2014–2015		Slovenia	2006–2009		Finland	2002–2014
	Ireland	2002–2008	0.65	Belgium	2002–2009		France	2008–2010
	Luxemburg	2002–2011, 2014, 2015		Finland	2014		Germany	2002–2015
	Netherlands	2002–2011, 2014, 2015		Austria	2011		Ireland	2002–2008
	Spain	2002–2009		Netherlands	2013–2014		Luxemburg	2002–2015
				Spain	2002–2003		Netherlands	2002–2014
			0.70	Finland	2011, 2012, 2015		Spain	2003–2009
				France	2011			
				Germany	2011			
				Luxemburg	2011, 2012			
				Netherlands	2011, 2012			
				Spain	2004–2008			
			0.75	Austria	2002–2010			
				Finland	2002–2010, 2013			
				France	2002–2010			
				Germany	2002–2010, 2012–2015			
				Ireland	2002–2008			
				Netherlands	2002–2010, 2015			
				Luxemburg	2002–2010, 2013–2015			

Table A.4
Estimates for Moody's with first order lags as instrumental variables, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Moody's rating																		
0.05	−**0.7718**	0.000	−**0.0272**	0.000	**0.1196**	0.000	**0.2586**	0.000	−**0.3085**	0.000	**4.2377**	0.000	−**0.0476**	0.000	−**0.0307**	0.000	9.150	0.593
0.10	−**0.5901**	0.000	−**0.0390**	0.000	**0.0580**	0.000	**0.0355**	0.000	−**0.3339**	0.000	**4.2815**	0.000	−**0.0361**	0.000	−**0.0158**	0.000	9.064	0.594
0.15	**0.8942**	0.000	−**0.0396**	0.000	**0.0158**	0.000	−**0.0143**	0.000	−**0.2801**	0.000	**3.7907**	0.000	−**0.0376**	0.000	−**0.0108**	0.000	8.801	0.609
0.20	**2.7490**	0.000	−**0.0412**	0.000	**0.0030**	0.000	−**0.0328**	0.000	−**0.2265**	0.000	**3.7852**	0.000	−**0.0367**	0.000	−**0.0104**	0.000	8.288	0.626
0.25	**5.8908**	0.000	−**0.0456**	0.000	−**0.0179**	0.008	−**0.1727**	0.000	−**0.1720**	0.000	**2.6823**	0.000	−0.0199	0.000	−**0.0165**	0.000	7.401	0.638
0.30	**4.6627**	0.000	−**0.0304**	0.000	−**0.1361**	0.000	−**0.1292**	0.000	−**0.0936**	0.000	**6.3281**	0.000	−**0.0177**	0.000	−**0.0087**	0.000	7.774	0.575
0.35	**4.2664**	0.000	−**0.0223**	0.000	−**0.0379**	0.000	−0.0257	0.283	−**0.1272**	0.000	**4.0622**	0.000	−**0.0298**	0.000	−**0.0172**	0.000	7.126	0.626
0.40	**3.9472**	0.000	−**0.0056**	0.015	−**0.0209**	0.024	0.0234	0.454	−**0.2066**	0.000	**3.2522**	0.000	−**0.0379**	0.000	−**0.0146**	0.000	7.578	0.585
0.45	**3.0212**	0.000	−**0.0035**	0.014	−**0.0707**	0.019	**0.0439**	0.018	−**0.2055**	0.000	**4.9529**	0.000	−**0.0403**	0.000	−**0.0176**	0.000	7.904	0.583
0.50	**2.7157**	0.001	0.0074	0.295	−**0.0648**	0.000	−0.0743	0.324	−**0.2392**	0.000	**3.2915**	0.000	−**0.0093**	0.038	−**0.0106**	0.000	7.792	0.554
0.55	**8.1312**	0.000	−**0.0318**	0.000	−0.0003	0.978	−**0.1885**	0.000	−**0.0999**	0.000	−0.0333	0.915	−**0.0224**	0.000	−**0.0122**	0.000	8.358	0.570
0.60	**5.4859**	0.000	−**0.0111**	0.030	−0.0309	0.159	−**0.1036**	0.025	−**0.1875**	0.000	**1.5205**	0.001	−**0.0290**	0.000	−**0.0091**	0.000	7.258	0.568
0.65	**8.1615**	0.000	−**0.0217**	0.000	−**0.0377**	0.000	−**0.1567**	0.012	−**0.0658**	0.000	**0.6343**	0.000	−**0.0157**	0.000	−0.0037	0.307	8.608	0.509
0.70	**9.4343**	0.000	−**0.0264**	0.000	−**0.0342**	0.000	−**0.0781**	0.021	−**0.0191**	0.015	0.2237	0.299	−**0.0193**	0.000	−**0.0052**	0.000	8.841	0.496
0.75	**10.5101**	0.000	−**0.0357**	0.000	−**0.0379**	0.003	−**0.1316**	0.000	0.0251	0.113	0.1774	0.398	−**0.0222**	0.000	−**0.0087**	0.001	8.983	0.502

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.5
Estimates for S&P's with first order lags as instrumental variables, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: S&P's rating																		
0.05	**0.2561**	0.223	−**0.0332**	0.000	**0.0996**	0.000	**0.1097**	0.000	−**0.3598**	0.000	**5.0597**	0.000	−**0.0704**	0.000	−**0.0224**	0.000	9.049	0.629
0.10	**3.1985**	0.000	−**0.0336**	0.000	**0.0123**	0.000	−**0.0188**	0.000	−**0.2321**	0.000	**3.1895**	0.000	−**0.0540**	0.000	−**0.0091**	0.000	8.277	0.666
0.15	**4.1839**	0.000	−**0.0403**	0.000	**0.0425**	0.000	−**0.1568**	0.000	−**0.2497**	0.000	**1.8321**	0.000	−**0.0425**	0.000	−**0.0128**	0.000	8.048	0.680
0.20	**3.8653**	0.000	−**0.0317**	0.000	**0.0616**	0.000	−**0.0849**	0.006	−**0.2305**	0.000	**2.4660**	0.000	−**0.0412**	0.000	−**0.0145**	0.000	8.034	0.684
0.25	**5.2135**	0.000	−**0.0386**	0.000	**0.0713**	0.002	−**0.1237**	0.000	−**0.2467**	0.000	**1.7475**	0.000	−**0.0456**	0.000	−**0.0167**	0.000	7.554	0.685
0.30	**4.5990**	0.000	−**0.0285**	0.000	**0.0421**	0.001	−**0.0986**	0.000	−**0.2503**	0.000	**2.4420**	0.000	−**0.0466**	0.000	−**0.0124**	0.000	7.663	0.682
0.35	**5.0184**	0.000	−**0.0234**	0.000	**0.0311**	0.000	−**0.1279**	0.000	−**0.1890**	0.000	**2.5447**	0.000	−**0.0393**	0.000	−**0.0154**	0.000	7.068	0.679
0.40	**7.0828**	0.000	−**0.0235**	0.000	−0.0323	0.452	−**0.2229**	0.000	−**0.2458**	0.000	**1.5197**	0.000	−**0.0227**	0.009	−**0.0113**	0.000	8.059	0.674
0.45	**5.8402**	0.000	−**0.0189**	0.000	−**0.0128**	0.593	−**0.1645**	0.016	−**0.2379**	0.000	**2.0647**	0.000	−**0.0289**	0.000	−**0.0088**	0.000	7.406	0.672
0.50	**6.6124**	0.000	−**0.0222**	0.000	−0.0113	0.212	−**0.2705**	0.000	−**0.2465**	0.000	**1.5298**	0.000	−**0.0210**	0.000	−**0.0053**	0.025	7.938	0.666
0.55	**5.1502**	0.000	−**0.0213**	0.000	−**0.0181**	0.029	0.0020	0.927	−**0.2167**	0.000	**3.6500**	0.000	−**0.0184**	0.000	−0.0004	0.863	7.684	0.664
0.60	**7.9678**	0.000	−**0.0281**	0.000	**0.0271**	0.007	−0.0017	0.957	−**0.1486**	0.000	−0.0360	0.907	−**0.0041**	0.081	−**0.0056**	0.000	8.517	0.661
0.65	**8.2714**	0.000	−**0.0321**	0.000	0.0111	0.416	−**0.2254**	0.007	−**0.1171**	0.000	**0.8732**	0.001	−**0.0254**	0.000	−0.0067	0.289	8.490	0.654
0.70	**10.5796**	0.000	−**0.0422**	0.000	−**0.0138**	0.002	−**0.1360**	0.000	−**0.0601**	0.000	**0.2215**	0.092	−**0.0039**	0.009	−**0.0071**	0.007	9.033	0.640
0.75	**11.5694**	0.000	−**0.0378**	0.000	−0.0127	0.122	−**0.1121**	0.000	−**0.0254**	0.000	**0.3859**	0.054	−0.0028	0.161	−0.0048	0.383	9.209	0.605

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.6
Estimates for Fitch with first order lags as instrumental variables, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Fitch rating																		
0.05	**0.5366**	0.000	**−0.0204**	0.000	**0.1048**	0.000	**−0.0159**	0.000	**−0.4264**	0.000	**1.6633**	0.000	**−0.0492**	0.000	**−0.0297**	0.000	9.113	0.587
0.10	**−0.4317**	0.000	**−0.0093**	0.000	**0.0646**	0.000	**−0.1265**	0.000	**−0.4788**	0.000	**3.5251**	0.000	**−0.0380**	0.000	**−0.0052**	0.000	9.028	0.611
0.15	**1.9404**	0.000	**−0.0240**	0.000	**0.0662**	0.000	**−0.1173**	0.000	**−0.4323**	0.000	**2.6932**	0.000	**−0.0421**	0.000	**−0.0042**	0.000	8.662	0.645
0.20	**3.7112**	0.000	**−0.0213**	0.000	**0.0246**	0.000	**−0.1000**	0.000	**−0.3350**	0.000	**2.6471**	0.000	**−0.0437**	0.000	**−0.0091**	0.000	8.086	0.663
0.25	**4.4816**	0.000	**−0.0185**	0.000	−0.0020	0.756	**−0.1843**	0.000	**−0.3376**	0.000	**2.3379**	0.000	**−0.0379**	0.000	**−0.0095**	0.000	7.643	0.664
0.30	**4.4702**	0.000	−0.0026	0.245	**−0.0674**	0.000	**−0.1153**	0.001	**−0.2963**	0.000	**3.8467**	0.000	**−0.0235**	0.000	**−0.0046**	0.000	6.999	0.633
0.35	**6.3135**	0.000	−0.0052	0.112	−0.0613	0.287	**−0.0742**	0.047	**−0.2090**	0.000	**2.7420**	0.000	**−0.0297**	0.005	**−0.0107**	0.000	7.962	0.625
0.40	**6.5421**	0.000	**−0.0082**	0.001	−0.0443	0.164	−0.1001	0.131	**−0.2181**	0.000	**2.3106**	0.000	**−0.0397**	0.000	**−0.0154**	0.000	7.765	0.626
0.45	**5.9594**	0.000	**−0.0117**	0.000	−0.0195	0.146	**−0.1031**	0.063	**−0.2269**	0.000	**2.6819**	0.000	**−0.0372**	0.000	−0.0039	0.284	7.676	0.637
0.50	**5.9069**	0.000	**−0.0177**	0.000	**−0.0405**	0.000	**−0.2021**	0.000	**−0.2611**	0.000	**2.1313**	0.000	**−0.0374**	0.000	**0.0053**	0.000	7.589	0.627
0.55	**7.3734**	0.000	**−0.0133**	0.000	**−0.0199**	0.000	**−0.0637**	0.000	**−0.2130**	0.000	**1.8956**	0.000	**−0.0221**	0.000	**−0.0048**	0.000	8.382	0.647
0.60	**6.1613**	0.000	**−0.0178**	0.000	**0.0217**	0.000	**−0.1767**	0.000	**−0.2968**	0.000	**0.3757**	0.000	**0.0073**	0.012	**−0.0087**	0.000	7.809	0.665
0.65	**7.9307**	0.000	**−0.0205**	0.000	−0.0029	0.756	**−0.0691**	0.002	**−0.2220**	0.000	**0.9636**	0.000	**−0.0079**	0.013	**0.0073**	0.010	8.627	0.623
0.70	**9.5834**	0.000	**−0.0344**	0.000	**−0.0781**	0.000	**−0.1846**	0.000	**−0.0804**	0.000	0.1674	0.263	**−0.0190**	0.000	**−0.0055**	0.013	8.806	0.625
0.75	**11.6596**	0.000	**−0.0355**	0.000	**−0.0642**	0.000	**−0.1174**	0.008	−0.0070	0.426	−0.1257	0.591	**−0.0129**	0.000	−0.0025	0.476	9.184	0.566

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.7
Estimates for Moody's using the US policy uncertainty index, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		US Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Moody's rating																		
0.05	**−1.0811**	0.000	**−0.0463**	0.000	**0.0798**	0.000	**0.1869**	0.000	**−0.3495**	0.000	**4.2204**	0.000	**−0.0390**	0.000	**−0.0105**	0.000	9.125	0.553
0.10	**−0.0365**	0.000	**−0.0510**	0.000	**0.0451**	0.000	**0.0346**	0.000	**−0.3460**	0.000	**3.5093**	0.000	**−0.0454**	0.000	**−0.0090**	0.000	9.039	0.570
0.15	**2.4221**	0.000	**−0.0460**	0.000	**−0.0298**	0.000	**−0.0239**	0.000	**−0.2643**	0.000	**3.6139**	0.000	**−0.0364**	0.000	**−0.0011**	0.000	8.360	0.602
0.20	**2.1861**	0.000	**−0.0416**	0.000	**−0.0049**	0.000	**0.0104**	0.000	**−0.2914**	0.000	**4.0044**	0.000	**−0.0434**	0.000	**−0.0050**	0.000	8.476	0.608
0.25	**2.8051**	0.000	**−0.0318**	0.000	**−0.0276**	0.000	−0.0144	0.324	**−0.2250**	0.000	**4.3131**	0.000	**−0.0399**	0.000	**−0.0102**	0.000	8.166	0.610
0.30	**4.2157**	0.000	**−0.0295**	0.000	**−0.0348**	0.003	**0.0851**	0.001	**−0.1798**	0.000	**5.0614**	0.000	**−0.0479**	0.000	0.0032	0.335	7.060	0.588
0.35	**3.8584**	0.000	**−0.0245**	0.000	**−0.0717**	0.000	0.0248	0.116	**−0.1511**	0.000	**4.7225**	0.000	**−0.0504**	0.000	**−0.0128**	0.000	7.579	0.586
0.40	**4.2968**	0.000	**−0.0250**	0.000	**−0.0368**	0.000	**−0.0411**	0.006	**−0.1663**	0.000	**3.7575**	0.000	**−0.0468**	0.000	−0.0013	0.569	7.228	0.586
0.45	**4.5009**	0.000	**−0.0082**	0.001	**−0.0256**	0.001	−0.0305	0.220	**−0.2563**	0.000	**3.5760**	0.000	**−0.0272**	0.000	**−0.0097**	0.001	7.050	0.577
0.50	**6.4926**	0.000	**−0.0153**	0.000	**−0.0811**	0.000	**−0.0845**	0.000	**−0.1773**	0.000	**1.9668**	0.000	**−0.0326**	0.000	**0.0087**	0.009	8.152	0.533
0.55	**6.7314**	0.000	**−0.0196**	0.000	−0.0078	0.120	**−0.0476**	0.000	**−0.1232**	0.000	**1.0435**	0.000	**−0.0358**	0.000	−0.0034	0.189	7.994	0.527
0.60	**5.9102**	0.000	**−0.0152**	0.000	**0.0328**	0.000	0.0019	0.842	**−0.2000**	0.000	**0.9797**	0.000	**−0.0174**	0.000	**−0.0127**	0.000	7.585	0.569
0.65	**7.5368**	0.000	**−0.0163**	0.001	−0.0560	0.363	−0.0246	0.267	**−0.0631**	0.000	0.8085	0.148	**−0.0128**	0.050	−0.0054	0.407	8.510	0.516
0.70	**8.2166**	0.000	**−0.0201**	0.000	**−0.0393**	0.000	**−0.1358**	0.000	**−0.0800**	0.000	**0.4679**	0.005	**−0.0192**	0.000	−0.0009	0.569	8.612	0.486
0.75	**9.5034**	0.000	**−0.0257**	0.000	**−0.0445**	0.000	**−0.1482**	0.000	−0.0332	0.463	**0.1742**	0.012	**−0.0156**	0.000	0.0140	0.174	8.951	0.420

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.8
Estimates for S&P's using the US policy uncertainty index, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		US Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: S&P's rating																		
0.05	**1.0733**	0.000	**−0.0455**	0.000	**0.0714**	0.000	**0.0970**	0.000	**−0.3025**	0.000	**4.1584**	0.000	**−0.0764**	0.000	**−0.0198**	0.000	8.965	0.615
0.10	**4.1456**	0.000	**−0.0398**	0.000	−0.0020	0.453	**−0.1039**	0.000	**−0.2420**	0.000	**2.2753**	0.000	**−0.0398**	0.000	0.0008	0.849	7.707	0.668
0.15	**7.3733**	0.000	**−0.0542**	0.000	**−0.0238**	0.034	**−0.1443**	0.000	**−0.1919**	0.000	**0.9407**	0.000	**−0.0364**	0.000	−0.0019	0.375	7.971	0.672
0.20	**4.3276**	0.000	**−0.0414**	0.000	**0.0767**	0.000	**−0.1416**	0.000	**−0.3205**	0.000	**2.6185**	0.000	**−0.0213**	0.000	**−0.0251**	0.000	7.819	0.658
0.25	**3.7672**	0.000	**−0.0248**	0.000	**0.0519**	0.000	**−0.0537**	0.000	**−0.2790**	0.000	**3.0710**	0.000	**−0.0452**	0.000	**−0.0125**	0.000	7.985	0.665
0.30	**5.3187**	0.000	**−0.0250**	0.000	**0.0143**	0.022	−0.0288	0.118	**−0.1949**	0.000	**3.5621**	0.000	**−0.0434**	0.000	−0.0016	0.595	7.281	0.660
0.35	**4.4419**	0.000	**−0.0306**	0.000	**−0.0248**	0.013	**−0.2510**	0.000	**−0.2719**	0.000	**2.8031**	0.000	**−0.0437**	0.000	**−0.0065**	0.000	7.605	0.666
0.40	**5.3021**	0.000	**−0.0213**	0.000	**0.0171**	0.006	**−0.1674**	0.000	**−0.2376**	0.000	**2.1254**	0.000	**−0.0342**	0.000	−0.0049	0.159	6.948	0.661
0.45	**7.2741**	0.000	**−0.0229**	0.000	**−0.0190**	0.079	**−0.1977**	0.000	**−0.2624**	0.000	**1.9839**	0.000	**−0.0313**	0.000	**−0.0075**	0.001	8.166	0.658
0.50	**5.8615**	0.000	**−0.0177**	0.000	0.0046	0.840	**−0.0878**	0.000	**−0.2357**	0.000	**2.3395**	0.000	−0.0001	0.991	−0.0002	0.918	8.089	0.666
0.55	**7.4878**	0.000	**−0.0125**	0.006	−0.0181	0.487	**−0.1858**	0.000	**−0.2607**	0.000	**1.8494**	0.000	**−0.0280**	0.000	**−0.0128**	0.024	8.271	0.624
0.60	**10.7138**	0.000	**−0.0381**	0.000	**−0.0661**	0.046	**−0.0819**	0.011	**−0.1080**	0.000	**0.6225**	0.000	**0.0086**	0.001	**−0.0283**	0.003	9.038	0.610
0.65	**9.8143**	0.000	**−0.0343**	0.000	**−0.0123**	0.000	**−0.1153**	0.013	**−0.0898**	0.000	**0.9291**	0.000	**−0.0075**	0.002	−0.0048	0.160	8.953	0.639
0.70	**10.7290**	0.000	**−0.0310**	0.000	**−0.0453**	0.000	**−0.2093**	0.000	**−0.0967**	0.000	0.4517	0.229	0.0012	0.819	**−0.0046**	0.082	9.105	0.610
0.75	**11.3388**	0.000	**−0.0399**	0.000	−0.0016	0.873	**−0.0665**	0.000	−0.0346	0.212	**0.3835**	0.026	**−0.0056**	0.009	−0.0114	0.331	9.147	0.614

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.9
Estimates for Fitch using the US policy uncertainty index, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		US Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Fitch rating																		
0.05	**1.6295**	0.000	**−0.0408**	0.000	**0.0589**	0.000	**−0.2168**	0.000	**−0.4458**	0.000	**1.1758**	0.000	**−0.0329**	0.000	**−0.0126**	0.000	8.871	0.603
0.10	**1.6581**	0.000	**−0.0250**	0.000	**0.0282**	0.000	**−0.2082**	0.000	**−0.4687**	0.000	**2.6636**	0.000	**−0.0468**	0.000	**−0.0029**	0.000	8.766	0.631
0.15	**1.9947**	0.000	**−0.0266**	0.000	**0.0478**	0.000	**−0.1543**	0.000	**−0.4698**	0.000	**2.7098**	0.000	**−0.0367**	0.000	**0.0032**	0.000	8.595	0.638
0.20	**2.9458**	0.000	**−0.0229**	0.000	**0.0318**	0.000	**−0.1051**	0.000	**−0.3810**	0.000	**3.0963**	0.000	**−0.0410**	0.000	**−0.0056**	0.000	8.305	0.653
0.25	**4.4844**	0.000	**−0.0155**	0.000	**−0.0428**	0.007	**−0.1952**	0.000	**−0.3602**	0.000	**2.8791**	0.000	**−0.0391**	0.000	**−0.0129**	0.009	7.594	0.644
0.30	**3.0192**	0.000	**−0.0124**	0.000	**0.0251**	0.000	**−0.0799**	0.000	**−0.3332**	0.000	**3.3293**	0.000	**−0.0371**	0.000	**−0.0040**	0.000	8.100	0.647
0.35	**4.5063**	0.000	**−0.0224**	0.000	−0.0132	0.727	**−0.0882**	0.000	**−0.1951**	0.000	**3.5161**	0.000	**−0.0263**	0.003	**−0.0115**	0.000	6.913	0.655
0.40	**6.3075**	0.000	**−0.0125**	0.000	**−0.0371**	0.000	**−0.1339**	0.000	**−0.1951**	0.000	**2.4441**	0.000	**−0.0405**	0.000	−0.0037	0.385	7.840	0.617
0.45	**6.6617**	0.000	**−0.0101**	0.000	**−0.0317**	0.000	**−0.0819**	0.000	**−0.2160**	0.000	**2.9831**	0.000	**−0.0413**	0.000	**−0.0104**	0.000	8.010	0.619
0.50	**5.8961**	0.000	**−0.0154**	0.000	−0.0149	0.280	**−0.1328**	0.000	**−0.2610**	0.000	**2.2834**	0.000	**−0.0234**	0.000	−0.0002	0.951	7.761	0.655
0.55	**8.9905**	0.000	**−0.0320**	0.000	−0.0097	0.399	**−0.1322**	0.000	**−0.2261**	0.000	0.2419	0.682	**−0.0257**	0.000	**−0.0029**	0.068	8.670	0.660
0.60	**9.4244**	0.000	**−0.0222**	0.000	**−0.0320**	0.000	−0.0241	0.223	**−0.2069**	0.000	**0.1083**	0.063	**−0.0037**	0.068	0.0002	0.484	8.873	0.633
0.65	**9.9326**	0.000	**−0.0195**	0.000	**−0.0603**	0.000	**−0.1353**	0.000	**−0.1377**	0.000	**0.8549**	0.000	**−0.0086**	0.001	**−0.0015**	0.090	8.989	0.604
0.70	**10.7658**	0.000	**−0.0315**	0.000	**−0.0450**	0.000	**−0.1552**	0.000	**−0.0706**	0.000	**0.8198**	0.000	**−0.0064**	0.000	0.0006	0.513	9.121	0.598
0.75	**12.0175**	0.000	**−0.0344**	0.000	**−0.0866**	0.000	**−0.1331**	0.000	0.0101	0.514	0.2083	0.143	**−0.0120**	0.000	−0.0014	0.787	9.253	0.545

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.10
Estimates for Moody's using the VSTOXX Index, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		VSTOXX		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Moody's rating																		
0.05	−**0.5947**	0.000	−**0.0573**	0.000	**0.0488**	0.000	−**0.0079**	0.000	−**0.3321**	0.000	**3.5708**	0.000	−**0.0418**	0.000	−**0.0036**	0.000	9.229	0.543
0.10	**1.8367**	0.000	−**0.0544**	0.000	−**0.0249**	0.000	−**0.1075**	0.000	−**0.3753**	0.000	**3.1279**	0.000	−**0.0413**	0.000	**0.0234**	0.000	8.797	0.594
0.15	**2.4471**	0.000	−**0.0463**	0.000	−**0.0266**	0.000	−**0.0721**	0.000	−**0.2755**	0.000	**3.6921**	0.000	−**0.0393**	0.000	**0.0264**	0.000	8.471	0.607
0.20	**1.9858**	0.000	−**0.0401**	0.000	**0.0180**	0.000	**0.0464**	0.000	−**0.2636**	0.000	**4.1464**	0.000	−**0.0379**	0.000	**0.0053**	0.000	8.553	0.602
0.25	**5.1499**	0.000	−**0.0494**	0.000	−**0.0642**	0.000	−0.0282	0.234	−**0.1466**	0.000	**4.6431**	0.000	−**0.0579**	0.000	−0.0179	0.321	7.211	0.593
0.30	**4.8611**	0.000	−**0.0471**	0.000	0.0014	0.872	0.0097	0.631	−**0.2757**	0.000	**2.7736**	0.000	−**0.0670**	0.000	**0.0650**	0.000	7.620	0.610
0.35	**4.3375**	0.000	−**0.0260**	0.000	−**0.0441**	0.000	−0.0513	0.249	−**0.2128**	0.000	**4.1043**	0.000	−**0.0429**	0.000	**0.0259**	0.001	7.190	0.601
0.40	**7.0711**	0.000	−**0.0493**	0.000	−**0.0652**	0.007	−**0.0409**	0.027	−**0.1993**	0.000	**1.9121**	0.000	−**0.0567**	0.000	**0.0448**	0.008	8.057	0.618
0.45	**5.7018**	0.000	−**0.0286**	0.000	−**0.0428**	0.000	−**0.0560**	0.002	−**0.2735**	0.000	**2.1918**	0.000	−**0.0442**	0.000	0.0049	0.478	7.329	0.607
0.50	**4.6937**	0.000	−**0.0096**	0.000	−**0.0620**	0.000	−0.0173	0.329	−**0.2571**	0.000	**2.1176**	0.000	−**0.0208**	0.000	**0.0653**	0.000	7.503	0.582
0.55	**4.5924**	0.000	−**0.0181**	0.000	−**0.0357**	0.000	−**0.1464**	0.000	−**0.2600**	0.000	**1.7677**	0.000	−**0.0428**	0.000	−**0.0203**	0.000	7.677	0.560
0.60	**4.8898**	0.000	−**0.0118**	0.003	0.0074	0.191	−**0.1001**	0.006	−**0.2677**	0.000	**1.7089**	0.000	−**0.0210**	0.000	−**0.0312**	0.001	7.219	0.553
0.65	**7.5341**	0.000	−**0.0170**	0.000	−0.0133	0.299	−0.0446	0.340	−0.0220	0.254	**1.0373**	0.004	−**0.0115**	0.001	**0.0667**	0.069	8.817	0.472
0.70	**8.8436**	0.000	−**0.0234**	0.000	−**0.0259**	0.000	−**0.1296**	0.000	−0.0081	0.261	**0.4023**	0.000	−**0.0185**	0.000	**0.0153**	0.003	8.939	0.445
0.75	**10.7643**	0.000	−**0.0320**	0.000	−**0.0740**	0.000	−**0.1761**	0.000	0.0085	0.111	−0.0944	0.117	−**0.0176**	0.000	**0.0189**	0.001	9.228	0.448

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.11
Estimates for S&P's using the VSTOXX Index, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		VSTOXX		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: S&P's rating																		
0.05	**4.3560**	0.000	−**0.0516**	0.000	−**0.0572**	0.000	**0.0556**	0.023	−**0.3047**	0.000	**3.6484**	0.000	−**0.0834**	0.000	−**0.0143**	0.076	8.264	0.629
0.10	**3.9244**	0.000	−**0.0411**	0.000	**0.0138**	0.030	−**0.1468**	0.000	−**0.2489**	0.000	**2.4025**	0.000	−**0.0423**	0.000	**0.0248**	0.000	7.965	0.668
0.15	**4.5966**	0.000	−**0.0362**	0.000	−**0.0065**	0.598	−**0.1074**	0.001	−**0.2612**	0.000	**1.6889**	0.000	−**0.0355**	0.000	−0.0061	0.497	7.597	0.674
0.20	**3.3710**	0.000	−**0.0334**	0.000	**0.0688**	0.000	−**0.1210**	0.000	−**0.3463**	0.000	**1.7185**	0.000	−**0.0413**	0.000	−**0.0227**	0.000	8.446	0.658
0.25	**3.3561**	0.000	−**0.0293**	0.000	**0.0422**	0.000	−**0.0631**	0.000	−**0.3292**	0.000	**2.4683**	0.000	−**0.0544**	0.000	−**0.0199**	0.000	8.440	0.654
0.30	**3.5936**	0.000	−**0.0281**	0.000	**0.0372**	0.000	−**0.1007**	0.000	−**0.3345**	0.000	**2.4101**	0.000	−**0.0525**	0.000	−**0.0182**	0.000	8.342	0.655
0.35	**5.8348**	0.000	−**0.0347**	0.000	−**0.0187**	0.002	−**0.1759**	0.000	−**0.2800**	0.000	**1.9644**	0.000	−**0.0442**	0.000	−**0.0437**	0.000	7.042	0.663
0.40	**6.5271**	0.000	−**0.0223**	0.000	−**0.0225**	0.008	−**0.2269**	0.000	−**0.2825**	0.000	**1.5658**	0.000	−**0.0274**	0.000	**0.0045**	0.055	8.031	0.658
0.45	**7.1554**	0.000	−**0.0267**	0.000	−**0.0329**	0.000	−**0.2049**	0.000	−**0.2592**	0.000	**1.8267**	0.000	−**0.0294**	0.000	0.0165	0.124	8.357	0.667
0.50	**4.6324**	0.000	−0.0008	0.913	−0.0185	0.325	−**0.1538**	0.000	−**0.2379**	0.000	**3.0916**	0.000	0.0003	0.972	−**0.0196**	0.050	7.735	0.616
0.55	**6.3325**	0.000	−**0.0167**	0.000	−0.0189	0.176	−**0.1476**	0.000	−**0.2969**	0.000	**1.5121**	0.000	−**0.0202**	0.000	−0.0048	0.541	8.034	0.653
0.60	**7.8473**	0.000	−**0.0304**	0.000	**0.0150**	0.098	−**0.0942**	0.052	−**0.2064**	0.000	**0.6148**	0.000	−**0.0116**	0.000	−0.0225	0.375	8.583	0.662
0.65	**7.3435**	0.000	−**0.0285**	0.000	−0.0088	0.293	−**0.2021**	0.000	−**0.2428**	0.000	**1.1100**	0.000	−**0.0111**	0.001	−0.0357	0.153	8.412	0.660
0.70	**10.7695**	0.000	−**0.0392**	0.000	−0.0406	0.232	−0.0197	0.525	−**0.0965**	0.000	0.0873	0.760	−0.0053	0.150	−0.0008	0.958	9.230	0.627
0.75	**11.4410**	0.000	−**0.0406**	0.000	−**0.0305**	0.018	−**0.1527**	0.000	−**0.0606**	0.000	0.3733	0.243	−**0.0034**	0.007	**0.0283**	0.000	9.355	0.614

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.12
Estimates for Fitch using the VSTOXX Index, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		VSTOXX		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Fitch rating																		
0.05	**1.3817**	0.000	**−0.0368**	0.000	**0.0683**	0.000	**−0.1674**	0.000	**−0.4793**	0.000	**1.1989**	0.000	**−0.0223**	0.000	**−0.0245**	0.000	8.973	0.600
0.10	**2.3787**	0.000	**−0.0293**	0.000	**0.0395**	0.000	**−0.1116**	0.000	**−0.4765**	0.000	**1.7970**	0.000	**−0.0451**	0.000	**0.0147**	0.000	8.764	0.634
0.15	**2.8089**	0.000	**−0.0307**	0.000	**0.0302**	0.000	**−0.1261**	0.000	**−0.4171**	0.000	**2.6206**	0.000	**−0.0469**	0.000	**0.0168**	0.000	8.568	0.646
0.20	**3.0571**	0.000	**−0.0253**	0.000	**0.0397**	0.000	**−0.1219**	0.000	**−0.3897**	0.000	**2.8993**	0.000	**−0.0384**	0.000	**−0.0114**	0.000	8.398	0.653
0.25	**3.1353**	0.000	**−0.0132**	0.000	**0.0062**	0.025	**−0.1439**	0.000	**−0.3742**	0.000	**2.9353**	0.000	**−0.0394**	0.000	**−0.0254**	0.000	8.329	0.640
0.30	**2.8284**	0.000	**−0.0112**	0.000	**0.0303**	0.000	**−0.0906**	0.000	**−0.3538**	0.000	**3.3367**	0.000	**−0.0393**	0.000	**−0.0212**	0.004	8.359	0.638
0.35	**4.1667**	0.000	**−0.0099**	0.000	0.0011	0.925	**−0.0345**	0.028	**−0.2514**	0.000	**3.4002**	0.000	**−0.0428**	0.000	**−0.0180**	0.000	7.465	0.629
0.40	**6.6971**	0.000	**−0.0142**	0.000	**−0.0407**	0.000	**−0.1192**	0.000	**−0.1881**	0.000	**2.3593**	0.000	**−0.0425**	0.000	**−0.0095**	0.000	8.169	0.613
0.45	**6.4497**	0.000	**−0.0146**	0.000	**−0.0203**	0.069	**−0.1356**	0.000	**−0.2512**	0.000	**2.0276**	0.000	**−0.0362**	0.000	−0.0020	0.903	8.018	0.635
0.50	**5.7450**	0.000	**−0.0150**	0.000	**−0.0202**	0.101	**−0.1498**	0.000	**−0.2540**	0.000	**2.2877**	0.000	**−0.0306**	0.000	−0.0204	0.481	7.611	0.644
0.55	**7.0485**	0.000	**−0.0089**	0.000	**−0.0380**	0.000	**−0.1156**	0.000	**−0.2421**	0.000	**1.7029**	0.000	**−0.0314**	0.000	−0.0002	0.970	8.359	0.612
0.60	**8.8340**	0.000	**−0.0168**	0.000	**−0.0326**	0.000	**−0.0333**	0.001	**−0.2350**	0.000	**0.6186**	0.000	**−0.0143**	0.000	0.0029	0.284	8.881	0.633
0.65	**10.4714**	0.000	**−0.0249**	0.000	**−0.0554**	0.000	**−0.0650**	0.000	**−0.1227**	0.000	**0.6952**	0.000	**−0.0113**	0.000	−0.0063	0.504	9.197	0.610
0.70	**10.3694**	0.000	**−0.0294**	0.000	**−0.0305**	0.000	**−0.1128**	0.000	**−0.0692**	0.000	**0.6678**	0.000	**−0.0067**	0.000	0.0093	0.221	9.213	0.598
0.75	**11.3894**	0.000	**−0.0319**	0.000	**−0.0706**	0.000	**−0.1248**	0.000	0.0042	0.744	**0.3957**	0.024	**−0.0111**	0.000	−0.0161	0.756	9.324	0.546

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.13
Estimates for Moody's using the logistic transformation of credit ratings, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Moody's rating																		
0.05	**1.1032**	0.000	**−0.0227**	0.000	**0.0374**	0.000	**−0.0102**	0.000	**−0.0550**	0.000	**0.7624**	0.000	**−0.0110**	0.000	**−0.0083**	0.000	6.402	0.594
0.10	**1.5177**	0.000	**−0.0178**	0.000	**0.0187**	0.000	**0.0272**	0.000	**−0.0571**	0.000	**0.6525**	0.000	**−0.0109**	0.000	**−0.0057**	0.000	7.062	0.647
0.15	**1.4150**	0.000	**−0.0133**	0.000	**0.0057**	0.000	**0.0218**	0.000	**−0.0637**	0.000	**1.0924**	0.000	**−0.0133**	0.000	**−0.0033**	0.000	7.185	0.685
0.20	**2.1942**	0.000	**−0.0108**	0.000	**0.0209**	0.000	**0.0346**	0.000	**−0.0151**	0.000	**1.2755**	0.000	**−0.0155**	0.000	**−0.0075**	0.000	7.920	0.716
0.25	**2.0932**	0.000	**−0.0090**	0.000	**0.0185**	0.000	**0.0427**	0.000	**−0.0270**	0.000	**1.4078**	0.000	**−0.0177**	0.000	**−0.0061**	0.000	7.874	0.713
0.30	**2.1249**	0.000	**−0.0088**	0.000	**0.0143**	0.000	**0.0292**	0.000	**−0.0219**	0.000	**1.5144**	0.000	**−0.0158**	0.000	**−0.0069**	0.000	7.934	0.714
0.35	**1.9753**	0.000	**−0.0054**	0.000	0.0037	0.147	**0.0163**	0.024	**−0.0380**	0.000	**1.7480**	0.000	**−0.0179**	0.000	**−0.0065**	0.000	7.860	0.699
0.40	**2.2048**	0.000	**−0.0079**	0.000	**0.0216**	0.000	**0.0140**	0.000	**−0.0458**	0.000	**1.2185**	0.000	**−0.0155**	0.000	**−0.0069**	0.000	7.906	0.713
0.45	**2.1618**	0.000	**−0.0067**	0.000	0.0003	0.911	**0.0126**	0.010	**−0.0450**	0.000	**1.7573**	0.000	**−0.0114**	0.000	**−0.0044**	0.000	8.088	0.707
0.50	**2.9363**	0.000	**−0.0095**	0.000	**−0.0006**	0.000	**0.0108**	0.000	**−0.0225**	0.000	**1.3902**	0.000	**−0.0115**	0.000	**−0.0037**	0.000	8.397	0.709
0.55	**2.7975**	0.000	**−0.0089**	0.000	**0.0053**	0.000	−0.0005	0.735	**−0.0292**	0.000	**1.3197**	0.000	**−0.0116**	0.000	**−0.0031**	0.000	8.336	0.705
0.60	**2.9579**	0.000	**−0.0094**	0.000	**0.0116**	0.000	0.0001	0.839	**−0.0196**	0.000	**1.2237**	0.000	**−0.0134**	0.000	**−0.0041**	0.000	8.363	0.703
0.65	**3.6052**	0.000	**−0.0117**	0.000	**−0.0029**	0.000	**−0.0130**	0.000	**−0.0058**	0.000	**1.0512**	0.000	**−0.0143**	0.000	**−0.0028**	0.000	8.574	0.690
0.70	**3.5192**	0.000	**−0.0108**	0.000	**−0.0135**	0.000	**−0.0361**	0.000	−0.0020	0.242	**1.1578**	0.000	**−0.0124**	0.000	**−0.0031**	0.000	8.570	0.687
0.75	**4.6784**	0.000	**−0.0182**	0.000	**−0.0155**	0.001	**−0.0430**	0.000	**0.0178**	0.000	**0.6108**	0.000	**−0.0180**	0.000	**−0.0022**	0.000	8.793	0.669

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.14
Estimates for S&P's using the logistic transformation of credit ratings, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: S&P's rating																		
0.05	**1.5817**	0.000	**−0.0223**	0.000	**0.0559**	0.000	**−0.0066**	0.000	**−0.0230**	0.000	0.0028	0.854	**−0.0126**	0.000	**−0.0029**	0.000	6.929	0.625
0.10	**2.4802**	0.000	**−0.0170**	0.000	**0.0209**	0.000	−0.0134	0.239	**−0.0320**	0.000	−0.0314	0.450	**−0.0095**	0.000	−0.0008	0.229	8.008	0.713
0.15	**2.3591**	0.000	**−0.0152**	0.000	**0.0151**	0.000	**−0.0382**	0.000	**−0.0227**	0.000	**0.2270**	0.000	**−0.0103**	0.000	**−0.0030**	0.000	7.947	0.739
0.20	**1.9495**	0.000	**−0.0124**	0.000	**0.0349**	0.000	**0.0023**	0.002	**−0.0315**	0.000	**0.5100**	0.000	**−0.0157**	0.000	**−0.0068**	0.000	7.518	0.744
0.25	**2.7208**	0.000	**−0.0121**	0.000	**0.0052**	0.500	**−0.0366**	0.009	**−0.0312**	0.000	**0.7436**	0.000	**−0.0116**	0.000	**−0.0033**	0.000	8.211	0.755
0.30	**2.2107**	0.000	**−0.0091**	0.000	**0.0146**	0.000	−0.0064	0.117	**−0.0407**	0.000	**1.2701**	0.000	**−0.0171**	0.000	**−0.0054**	0.000	7.925	0.750
0.35	**2.7392**	0.000	**−0.0103**	0.000	**0.0261**	0.000	**−0.0143**	0.000	**−0.0413**	0.000	**0.9204**	0.000	**−0.0145**	0.000	**−0.0064**	0.000	8.169	0.757
0.40	**2.7061**	0.000	**−0.0099**	0.000	**0.0243**	0.000	**−0.0303**	0.000	**−0.0527**	0.000	**0.8854**	0.000	**−0.0063**	0.000	**−0.0067**	0.000	8.226	0.753
0.45	**2.8194**	0.000	**−0.0112**	0.000	**0.0131**	0.000	**−0.0105**	0.000	**−0.0207**	0.000	**1.2592**	0.000	**−0.0150**	0.000	**−0.0042**	0.000	8.289	0.753
0.50	**3.2946**	0.000	**−0.0121**	0.000	**0.0080**	0.000	**−0.0087**	0.000	**−0.0146**	0.000	**1.1768**	0.000	**−0.0134**	0.000	**−0.0020**	0.000	8.497	0.743
0.55	**3.8432**	0.000	**−0.0133**	0.000	**−0.0094**	0.001	**−0.0473**	0.000	**−0.0180**	0.003	**0.9677**	0.000	**−0.0112**	0.000	**−0.0015**	0.028	8.656	0.733
0.60	**3.4735**	0.000	**−0.0133**	0.000	**0.0072**	0.000	**−0.0220**	0.000	−0.0012	0.137	**1.0589**	0.000	**−0.0105**	0.000	**−0.0038**	0.000	8.551	0.746
0.65	**3.3608**	0.000	**−0.0125**	0.000	**0.0114**	0.000	**−0.0201**	0.000	**−0.0163**	0.000	**1.0201**	0.000	**−0.0105**	0.000	**−0.0030**	0.000	8.513	0.748
0.70	**3.5504**	0.000	**−0.0133**	0.000	**0.0166**	0.000	**−0.0480**	0.000	**−0.0090**	0.000	**0.8911**	0.000	**−0.0089**	0.000	**−0.0060**	0.000	8.542	0.749
0.75	**3.6980**	0.000	**−0.0142**	0.000	**0.0318**	0.000	**−0.0176**	0.000	**−0.0071**	0.000	**0.7027**	0.000	**−0.0127**	0.000	**−0.0058**	0.000	8.546	0.749

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.15
Estimates for Fitch using the logistic transformation of credit ratings, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Fitch rating																		
0.05	**2.0925**	0.000	**−0.0170**	0.000	**0.0298**	0.001	0.0623	0.468	−0.0868	0.132	0.0996	0.734	−0.0227	0.143	−0.0003	0.959	7.402	0.676
0.10	**2.0858**	0.000	**−0.0131**	0.000	**0.0159**	0.000	**−0.0207**	0.000	**−0.0623**	0.000	**0.2304**	0.000	**−0.0117**	0.000	**−0.0038**	0.000	7.659	0.718
0.15	**1.8391**	0.000	**−0.0116**	0.000	**0.0241**	0.000	**−0.0230**	0.000	**−0.0628**	0.000	**0.5185**	0.000	**−0.0148**	0.000	**−0.0037**	0.000	7.462	0.732
0.20	**2.0147**	0.000	**−0.0093**	0.000	**0.0145**	0.000	**−0.0239**	0.000	**−0.0559**	0.000	**1.3751**	0.000	**−0.0173**	0.000	**−0.0040**	0.000	7.681	0.736
0.25	**2.5496**	0.000	**−0.0112**	0.000	**0.0162**	0.000	**−0.0265**	0.000	**−0.0269**	0.000	**1.3764**	0.000	**−0.0172**	0.000	**−0.0048**	0.000	7.837	0.737
0.30	**2.2540**	0.000	**−0.0052**	0.000	**0.0206**	0.028	0.0133	0.258	**−0.0432**	0.000	**1.6239**	0.001	**−0.0123**	0.000	**−0.0065**	0.000	8.011	0.735
0.35	**2.3828**	0.000	**−0.0105**	0.000	**0.0225**	0.000	**−0.0287**	0.011	**−0.0551**	0.000	**1.2426**	0.000	**−0.0166**	0.000	**−0.0049**	0.000	8.327	0.746
0.40	**2.2575**	0.000	**−0.0067**	0.000	**0.0132**	0.000	**0.0078**	0.000	**−0.0407**	0.000	**1.4678**	0.000	**−0.0184**	0.000	**−0.0042**	0.000	7.975	0.738
0.45	**2.7712**	0.000	**−0.0091**	0.000	**0.0137**	0.000	0.0029	0.157	**−0.0366**	0.000	**1.3434**	0.000	**−0.0149**	0.000	**−0.0038**	0.000	8.114	0.742
0.50	**3.1470**	0.000	**−0.0115**	0.000	**−0.0022**	0.000	**−0.0072**	0.000	**−0.0296**	0.000	**1.2347**	0.000	**−0.0148**	0.000	**−0.0016**	0.000	8.475	0.739
0.55	**2.8728**	0.000	**−0.0095**	0.000	−0.0003	0.735	**−0.0276**	0.000	**−0.0247**	0.000	**1.5375**	0.000	**−0.0142**	0.000	**−0.0021**	0.000	8.493	0.737
0.60	**3.1799**	0.000	**−0.0104**	0.000	**0.0014**	0.000	**−0.0277**	0.000	**−0.0306**	0.000	**1.2051**	0.000	**−0.0151**	0.000	**−0.0013**	0.000	8.464	0.738
0.65	**3.4661**	0.000	**−0.0115**	0.000	0.0000	0.979	**−0.0118**	0.000	**−0.0281**	0.000	**1.0828**	0.000	**−0.0155**	0.000	**−0.0010**	0.000	8.561	0.734
0.70	**4.0320**	0.000	**−0.0132**	0.000	**−0.0094**	0.002	**−0.0325**	0.000	**−0.0112**	0.001	**0.8881**	0.000	**−0.0144**	0.000	**−0.0019**	0.000	8.690	0.734
0.75	**4.7317**	0.000	**−0.0170**	0.000	0.0003	0.947	**−0.0524**	0.000	−0.0020	0.663	**0.7137**	0.000	**−0.0093**	0.000	−0.0016	0.126	8.926	0.711

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.16
Estimates for Moody's using 0.25, 0.50, 0.75 quantiles only, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Moody's rating																		
0.25	**4.8044**	0.000	**−0.0454**	0.000	**−0.0233**	0.000	**−0.0535**	0.000	**−0.1833**	0.000	**3.4437**	0.000	**−0.0371**	0.000	**−0.0155**	0.000	7.433	0.638
0.50	−0.4957	0.402	0.0029	0.346	**−0.1765**	0.000	**−0.0599**	0.024	**−0.3933**	0.000	**4.2232**	0.000	**−0.0342**	0.000	**−0.0164**	0.000	9.119	0.480
0.75	**8.3338**	0.000	**−0.0307**	0.000	**−0.0621**	0.000	**0.0611**	0.002	**−0.0276**	0.000	**0.8808**	0.000	**−0.0283**	0.000	0.0003	0.847	8.780	0.541

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.17
Estimates for S&P's using 0.25, 0.50, 0.75 quantiles only, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: S&P's rating																		
0.25	**5.1247**	0.000	**−0.0322**	0.000	**0.0435**	0.000	**−0.1412**	0.000	**−0.2650**	0.000	**2.2195**	0.000	**−0.0372**	0.000	**−0.0169**	0.000	7.457	0.689
0.50	**6.3872**	0.000	**−0.0206**	0.000	**0.0241**	0.000	**−0.1118**	0.000	**−0.2036**	0.000	**1.5716**	0.000	**−0.0249**	0.000	**−0.0088**	0.000	7.949	0.676
0.75	**11.7268**	0.000	**−0.0385**	0.000	−0.0024	0.858	**−0.0624**	0.045	**−0.0257**	0.013	0.0438	0.654	−0.0032	0.164	**−0.0108**	0.000	9.336	0.618

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.18
Estimates for Fitch using 0.25, 0.50, 0.75 quantiles only, 2002–2015.

	Log GDP per capita		Government Debt		Current Account		Inflation Rate		Unemployment Rate		Regulatory Quality		Competitiveness		Uncertainty		AIC	Pseudo R^2
quantile	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.	coef.	p-val.		
Dependent Variable: Fitch rating																		
0.25	**5.1840**	0.000	**−0.0217**	0.000	−0.0157	0.590	**−0.1585**	0.000	**−0.3349**	0.000	**3.1566**	0.000	**−0.0411**	0.000	**−0.0087**	0.000	7.116	0.667
0.50	**6.2213**	0.000	**−0.0188**	0.000	**−0.0361**	0.000	**−0.1417**	0.000	**−0.2789**	0.000	**1.9710**	0.000	**−0.0322**	0.000	−0.0006	0.470	7.856	0.657
0.75	**8.4409**	0.000	**−0.0277**	0.000	**−0.0433**	0.000	**0.0747**	0.024	**−0.2333**	0.000	**1.1140**	0.000	**−0.0239**	0.000	**0.0168**	0.000	8.865	0.594

Notes: Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

Table A.19
Estimates of time-varying model (7) and (8) in main text, 2002–2015.

	Moody's		S&P's		Fitch	
	coef.	p-val.	coef.	p-val.	coef.	p-val.
Constant	−22.650	0.187	−24.337	0.117	**−38.787**	0.010
Uncertainty < Sample Mean						
Log GDP per capita	**11.063**	0.004	**10.812**	0.002	**14.551**	0.000
Government Debt	**−0.083**	0.000	**−0.048**	0.000	**−0.065**	0.000
Current Account	**−0.065**	0.019	−0.031	0.212	−0.035	0.145
Inflation Rate	**−0.161**	0.004	**−0.253**	0.000	**−0.263**	0.000
Unemployment Rate	**−0.180**	0.003	**−0.255**	0.000	**−0.246**	0.000
Regulatory Quality	0.811	0.341	**1.655**	0.032	**1.647**	0.028
Competitiveness	**−0.037**	0.002	**−0.031**	0.005	**−0.040**	0.000
Uncertainty	0.007	0.363	0.005	0.432	0.002	0.748
Fiscal Balance	−0.021	0.649	−0.020	0.618	−0.031	0.437
Uncertainty > Sample Mean						
Log GDP per capita	**11.573**	0.006	**12.230**	0.001	**16.293**	0.000
Government Debt	**−0.102**	0.000	**−0.068**	0.000	**−0.073**	0.000
Current Account	−0.030	0.356	0.018	0.535	0.023	0.422
Inflation Rate	0.096	0.454	−0.169	0.144	0.037	0.742
Unemployment Rate	**−0.173**	0.000	**−0.205**	0.000	**−0.194**	0.000
Regulatory Quality	**1.749**	0.014	**1.614**	0.013	**1.568**	0.012
Competitiveness	**−0.034**	0.004	−0.015	0.151	**−0.017**	0.093
Uncertainty	−0.016	0.505	−0.035	0.102	**−0.050**	0.016
Fiscal Balance	**0.067**	0.040	**0.049**	0.098	**0.060**	0.036
R^2	0.663		0.719		0.683	
AIC	7.274		7.130		7.296	

F-test for equality of coefficients

		Moody's	S&P's	Fitch
Log GDP per capita	F(1, 218)	0.22	2.08	**3.34**
	Prob > F	0.640	0.150	0.069
Government Debt	F(1, 218)	**7.43**	**10.27**	1.75
	Prob > F	0.007	0.002	0.187
Current Account	F(1, 218)	0.82	2.07	**3.06**
	Prob > F	0.366	0.152	0.082
Inflation Rate	F(1, 218)	**3.28**	0.430	**5.84**
	Prob > F	0.071	0.512	0.016
Unemployment Rate	F(1, 218)	0.02	1.330	1.53
	Prob > F	0.882	0.250	0.217
Regulatory Quality	F(1, 218)	2.24	0.01	0.02
	Prob > F	0.136	0.942	0.886
Competitiveness	F(1, 218)	0.10	**2.97**	**7.00**
	Prob > F	0.746	0.086	0.009
Uncertainty	F(1, 218)	0.95	**3.68**	**6.57**
	Prob > F	0.331	0.056	0.011
Fiscal Balance	F(1, 218)	2.69	2.05	**3.77**
	Prob > F	0.102	0.154	0.054

Notes: Model (7) and (8) in main text allows for the impact of all explanatory variables on credit rating decisions to change during periods of low policy uncertainty (when uncertainty is below its sample mean) as opposed to periods of high uncertainty when uncertainty is above its sample mean). Figures in bold indicate significance at the 10% level or lower. AIC is the Akaike Information Criterion.

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